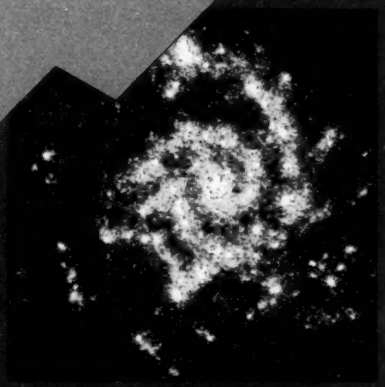
Scientific and Technical Aerospace Reports

STAR



An Abstract Journal

Volume 30, Number 12
June 23, 1992
N92-21071 to N92-22095

Scientific and Technical Aerospace Reports

Scientific and Technical Aerospace Reports (STAR) is an abstract journal that provides comprehensive coverage of worldwide aerospace-related reports. It is a major product of the International Aerospace Database managed by the NASA Scientific and Technical Information (STI) Program. The coverage includes reports on aeronautics, space, and supporting disciplines. *STAR* lists current, publicly available reports entered into the NASA STI Database during the 2-week period preceding publication. A typical citation and abstract appear on page viii. They explain how to read the items that are announced in this journal.

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03 AIR TRANSPORTATION AND SAFETY **1922**
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04 AIRCRAFT COMMUNICATIONS AND NAVIGATION **1926**
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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE **1928**
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06 AIRCRAFT INSTRUMENTATION ..... **N.A.**
Includes cockpit and cabin display devices; and flight instruments. For related information see also *19 Space craft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER **1935**
Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL **1936**
Includes aircraft handling qualities; piloting; flight controls; and autopilots. For related information see also *05 Aircraft Design, Testing and Performance.*

09 RESEARCH AND SUPPORT FACILITIES (AIR) **1937**
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14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) **1941**
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15 LAUNCH VEHICLES AND SPACE VEHICLES **1941**
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16 SPACE TRANSPORTATION **1941**
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17 SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING . **1942**
Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout. For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N.A.—no abstracts were assigned to this category for this issue.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE **1946**
Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

19 SPACECRAFT INSTRUMENTATION ..... **N.A.**
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER **1947**
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

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25 INORGANIC AND PHYSICAL CHEMISTRY **1970**
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26 METALLIC MATERIALS **1974**
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28 PROPELLANTS AND FUELS **1980**
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31 ENGINEERING (GENERAL) **1981**
Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 COMMUNICATIONS AND RADAR **1981**
Includes radar; land and global communications; communications theory; and optical communications. For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING **1986**
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34 FLUID MECHANICS AND HEAT TRANSFER **1990**
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35 INSTRUMENTATION AND PHOTOGRAPHY **1995**
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37 MECHANICAL ENGINEERING **2000**
Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **2004**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **2005**
Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) ..... **N.A.**

43 EARTH RESOURCES AND REMOTE SENSING **2007**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **2009**
Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

45 ENVIRONMENT POLLUTION **2011**
Includes atmospheric, noise, thermal, and water pollution.

46 GEOPHYSICS **2015**
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48 OCEANOGRAPHY **2018**
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53 BEHAVIORAL SCIENCES **2022**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **2022**
Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also *16 Space Transportation.*

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61 COMPUTER PROGRAMMING AND SOFTWARE **2030**
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62 COMPUTER SYSTEMS **2035**
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63 CYBERNETICS **2037**
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64 NUMERICAL ANALYSIS **2039**
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71 ACOUSTICS **2045**
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Includes atomic structure, electron properties, and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS **2051**
Includes elementary and nuclear particles; and reactor theory. For space radiation see *93 Space Radiation.*

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Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

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Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see *61 Computer Programming and Software.*

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84 LAW, POLITICAL SCIENCE AND SPACE POLICY ..... **N.A.**
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Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

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89 ASTRONOMY **2078**
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

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Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also *75 Plasma Physics*.

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Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

92 SOLAR PHYSICS **2095**
Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

93 SPACE RADIATION **2096**
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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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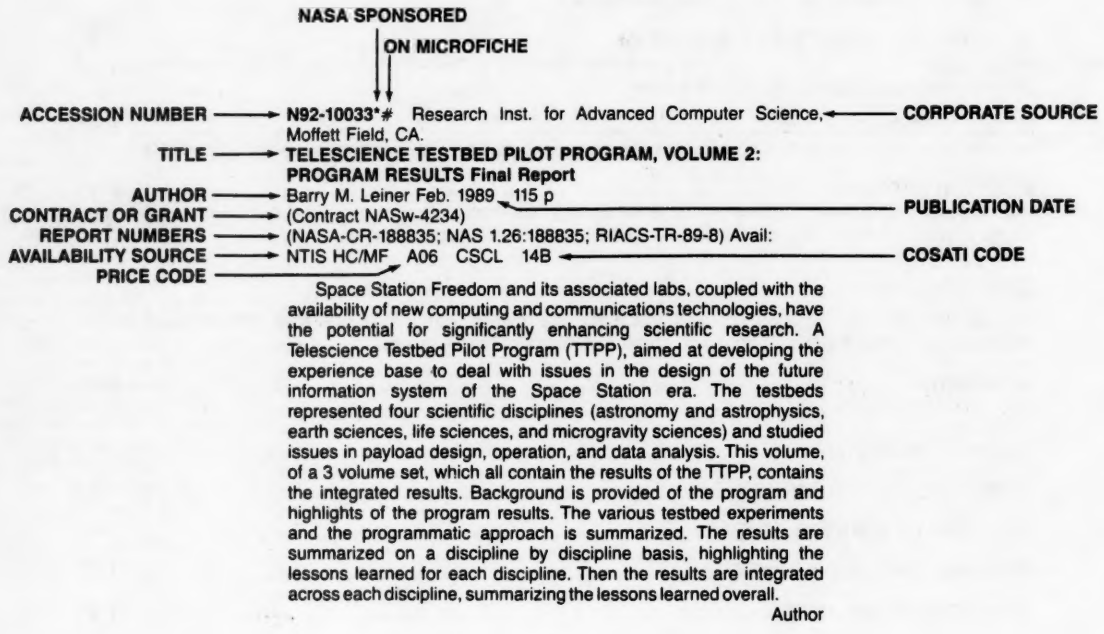
TYPICAL CITATION AND ABSTRACT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ACCESSION NUMBER
N92-10033*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
CORPORATE SOURCE
TITLE
TELESCIENCE TESTBED PILOT PROGRAM, VOLUME 2: PROGRAM RESULTS Final Report
AUTHOR
Barry M. Leiner Feb. 1989 115 p
CONTRACT OR GRANT
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PUBLICATION DATE
REPORT NUMBERS
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NTIS HC/MF A06 CSCL 14B
COSATI CODE
PRICE CODE
Space Station Freedom and its associated labs, coupled with the availability of new computing and communications technologies, have the potential for significantly enhancing scientific research. A Telescience Testbed Pilot Program (TTPP), aimed at developing the experience base to deal with issues in the design of the future information system of the Space Station era. The testbeds represented four scientific disciplines (astronomy and astrophysics, earth sciences, life sciences, and microgravity sciences) and studied issues in payload design, operation, and data analysis. This volume, of a 3 volume set, which all contain the results of the TTPP, contains the integrated results. Background is provided of the program and highlights of the program results. The various testbed experiments and the programmatic approach is summarized. The results are summarized on a discipline by discipline basis, highlighting the lessons learned for each discipline. Then the results are integrated across each discipline, summarizing the lessons learned overall.
Author

VOLUME 30 NUMBER 12 / JUNE 23, 1992

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N92-21501# Wichita State Univ., KS. National Inst. for Aviation Research.
TECHFEST 18 PROCEEDINGS
Brent D. Bowen, ed. Jan. 1992 24 p Technologyfest held in Wichita, KS, 15-16 Nov. 1991; sponsored by AIAA and Wichita State Univ.
(NIAR-92-1) Avail: NTIS HC/MF A03 CSCL 01B

The techfest provided an opportunity to exchange information on the state-of-the-art aviation topics. The areas covered include: (1) NASA research; (2) interdisciplinary research in aviation/aerospace; (3) key needs in general aviation research; (4) advanced computer tools; (5) commercially viable composites; and (6) aircraft design studies. For individual titles, see N92-21502 through N92-21514.

N92-21502*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AERONAUTICAL RESEARCH IN THE UNITED STATES: CHALLENGES FOR THE 1990'S Abstract Only
Bruce J. Holmes *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

New opportunities for greater performance civil air transportation aircraft derive from the continuing advancements in the aeronautical disciplines: advancements in aerodynamics, structures and materials, propulsion, and flight control technologies. These opportunities impact future subsonic transports, high speed civil transports, and hypersonic vehicles. There are, however, new constraints within which progress will be made, including stringent environmental constraints on engine emissions and noise, old and new safety constraints on operations (especially in severe weather), aging airframes, and changing transportation marketplace demands affecting all of these vehicle classes. Some of the NASA aeronautical research programs will be discussed in four areas: (1) advanced subsonic airplanes; (2) next generation high speed civil transport aircraft (SST's); (3) high performance military aircraft; and (4) next century hypersonic vehicles. This presentation overviews the exciting progress which is possible in aeronautics during the 1990's. Author

N92-21503*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COCKPIT WEATHER INFORMATION NEEDS Abstract Only **c03**
Charles H. Scanlon *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 2 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01C

The primary objective is to develop an advanced pilot weather interface for the flight deck and to measure its utilization and effectiveness in pilot reroute decision processes, weather situation awareness, and weather monitoring. Identical graphical weather displays for the dispatcher, air traffic control (ATC), and pilot crew should also enhance the dialogue capabilities for reroute decisions. By utilizing a broadcast data link for surface observations, forecasts, radar summaries, lightning strikes, and weather alerts, onboard weather computing facilities construct graphical displays, historical weather displays, color textual displays, and other tools to assist the pilot crew. Since the weather data is continually being received and stored by the airborne system, the pilot crew has instantaneous access to the latest information. This information is color coded to distinguish degrees of category for surface observations, ceiling and visibilities, and ground radar summaries. Automatic weather monitoring and pilot crew alerting is accomplished by the airborne computing facilities. When a new weather information is received, the displays are instantaneously changed to reflect the new information. Also, when a new surface or special observation for the intended destination is received, the pilot crew is informed so that information can be studied at the pilot's discretion. The pilot crew is also immediately alerted when a severe weather notice, AIRMET or SIGMET, is received. The cockpit weather display shares a multicolor eight inch cathode ray tube and overlaid touch panel with a pilot crew data link interface. Touch sensitive buttons and areas are used for pilot selection of graphical and data link displays. Time critical ATC messages are presented in a small window that overlays other displays so that immediate pilot alerting and action can be taken. Predeparture and reroute clearances are displayed on the graphical weather system so pilot review of weather along the route can be accomplished prior to pilot acceptance of the clearance. An ongoing multiphase test series is planned for testing and modifying the graphical weather system. Preliminary data shows that the nine test subjects considered the graphical presentation to be much better than their current weather information source for situation awareness, flight safety, and reroute decision making. Author

N92-21504# Kansas Univ., Lawrence. Flight Research Lab.
ACTIVE FLOW CONTROL FOR TWENTY-FIRST CENTURY HIGH-PERFORMANCE AIRCRAFT WITH APPLICATIONS TO LAND AND SEA VEHICLES Abstract Only **c02**
Saeed Farokhi *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

Future high-performance aircraft will be designed as an integrated system of 'smart components' with massive, distributed active-flow-control units. Here, the smart components are referred to as elements of an aircraft system with adaptive logic capability. These components will then perform 'optimally' under the most severe flight conditions. A few examples seem in order at this point. A delta wing at high angle of attack or yaw which can dictate its vortex burst locations; a subsonic diffuser which actively controls flow separation and engine-face distortion levels in a maneuvering aircraft; a compressor equipped with an active surge control unit; a propulsion installation in a multi-engined aircraft which can minimize its boattail and base drag in subsonic, transonic, and supersonic flight corridors; and active control of three-dimensional separation on bodies of revolution in yaw represent just a few applications of adaptive logic philosophy. To realize the aforementioned advances in a practical operating unit, one must establish the following: (1) distributed flow sensors at 'critical' locations; (2) a central processing unit with data link to A/C flight computer; (3) 'suitable' active flow manipulators: e.g., type, frequency response, amplitude; and (4) a self-optimizing, closed-loop (feedback) control of the active flow devices. This is a formidable and challenging task with tremendous payoffs for aeronautics as well as spin-off applications to land and sea vehicles.

Active flow control units integrated into cars and trucks will reduce vehicle drag and enhance stability at highway speeds. Similarly, submarines will be able to maneuver with enhanced stability, quietly, and with minimum propulsive requirements. Author

N92-21505# Wichita State Univ., KS. National Inst. for Aviation Research.
COOPERATIVE RESEARCH: ONE ANSWER TO MAINTAINING THE COMPETITIVE EDGE Abstract Only
Bill Wentz *In its* Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

As the U.S. aviation industry faces increasing competition from Europe and Asia, it is increasingly important that Kansas aviation firms remain competitive. Clearly, we need to develop better products, special skills, and productivity and quality standards which more than compensate for our higher wages and salaries. One of the ways to remain competitive is through continuous product and process improvement. This means giving more consideration to retraining and upgrading a stable work force. It also means making sustained investment in research and development to achieve continuous improvement. Further, we must work to reduce the time lag between discovery and product. This time lag can most effectively be reduced by cooperative research involving strong interaction by designers from industry with university and federal laboratory researchers, and with representatives from regulatory agencies. If we are successful in achieving effective teamwork to quickly bring research concepts from the laboratory into the production shop, we will maintain the leadership role in aviation which this nation has traditionally held. One of the characteristics of Japanese and European firms is their willingness to participate in joint research, with shared funding and partnerships which assure that all participants share equitably in the results. The National Institute for Aviation Research is seeking to form consortia relationships among the firms with common research needs. The paper will describe several case histories of joint government-industry-university research and development in aviation, and suggest opportunities for future cooperation. Author

N92-21506# Palo Alto Coll., CA. Dept. of Aviation Technology.
FORGETTING A TASK: STRATEGIES FOR ENHANCING THE PILOT'S MEMORY Abstract Only **c53**
Gary J. Northam *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

Action slips are classified as occurring in one of three major categories: (1) intention; (2) activation; and/or (3) triggering. Errors occurring in each of these will have differing causes and consequently differing remedies. This research attempts to define one kind of activation error with an emphasis on defining strategies that may help eliminate that kind of error. Forgetting was identified as an ever occurring problem in the cockpit. It is classified as an activation error because the organized memory unit is not brought into conscious thought so that the task may be accomplished. The fact that activation does not occur depends on the kind of memory that is needed for the task. Recent memory research indicates that there are three stages of memory. This research project seeks to connect this memory research with action slip error descriptions. When a particular error is defined as a memory error, that action may be defined according to a theory of action and a particular memory stage. The particular memory error is then analyzed and suggested strategies provided to help eliminate the problem. Author

N92-21507# Kansas State Univ., Salina. Dept. of Aeronautical Studies.
THE AVIATION EDUCATION/RESEARCH ENDEAVORS AT KANSAS STATE UNIVERSITY, COLLEGE OF TECHNOLOGY, SALINA Abstract Only **c80**
Ken Barnard *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

The FAA Part 147 Airframe and Powerplant curriculum is a two year degree program with a current facilities expansion project to obtain an additional 21,000 sq ft attachment to the existing 15,000 sq ft pilot training facility. There will be two four year degrees initially offered in Mechanical and Electronic Engineering Technology. But, as a nonresearch technology college within KSU, research partnerships are being sought with other universities to provide mutual benefiting services. The pilot training and maintenance expertise may support aviation research. For example, testing pilot response, cockpit design, cockpit management procedures and the like could be done with the 96 current pilot students providing the instrument sample. Over 30 airplanes and helicopters are owned that could be used in testing research; one example is a Beechcraft Duke, a cabin class twin engine aircraft that is complete with engines and props that flies 15 knots slower than any other similar production model. Studies could be conducted to determine why this anomaly exists for this airplane. Author

N92-21508# Wichita State Univ., KS. National Inst. for Aviation Research.
THE AIRLINE QUALITY RATING: AN EXAMPLE OF ISSUE-BASED RESEARCH AT THE NATIONAL INSTITUTE FOR AVIATION RESEARCH Abstract Only **c03**
Dean Headley and Brent Bowen *In its* Techfest 18 Proceedings Jan. 1992 2 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

Cooperative research in a variety of nontechnical areas is carried out at the Institute. Faculty associates from colleges across campus participate in research through the Institute. Topics such as airline quality, historical trends in airline performance, study of women and minorities in aviation education, and development of aviation management courses and teaching materials all receive attention via the Institute. The most recent and visible of these research efforts is the development and use of the Airline Quality Rating (AQR). The AQR methodology ranks 10 major U.S. domestic airlines using quantifiable, regularly available data and a standard set of 19 quality factors. Development of the AQR involved identifying a lengthy list of potential quality factors through literature search, discussions with experts from airline associations, government agencies, each of the 10 major airlines, and a variety of other sources. It is believed that periodic rating of airlines using the AQR will be of interest to airline industry watchers and business strategists as they attempt to judge the comparative quality of airlines. The rating approach has good statistical reliability and ranking results from the AQR generally agree with other national consumer survey based rankings for the same airlines. Author

N92-21509# Nebraska Univ., Omaha. Inst. of Aviation.
COOPERATIVE PLANNING IN AVIATION CONTEXTS Abstract Only **c04**
C. Elaine McCoy *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

Design concepts and principles are developed and evaluated to guide in the building of cooperative problem solving systems, particularly the design of cooperative systems for enroute flight planning. A three stage process was studied of modeling human performance in existing environments, building cognitive artifacts, and studying the performance of people working in collaboration with these artifacts. The most significant design concepts and principles identified thus far are summarized. The first stage of research involves the use of a part task simulation. Those concepts that prove most promising based on this initial evaluation will then be used in a second stage in the NASA Ames Advanced Concepts Simulator. In order to run experiments using a part task simulation, the researchers have designed an environment that can support the development and testing of a variety of design concepts. This prototyping shell, designed to run on a Mac IIfx, provides a general environment for developing application software, but does not prohibit programmers from modifying the environment if necessary. Written in Lightspeed C, the system can control displays on up to four color monitors. Author

N92-21510# Wichita State Univ., KS. Dept. of Mechanical Engineering.
A STUDY IN DYNAMIC CONTROL OF A SUPER MANEUVER WITH NEURAL NETWORKS Abstract Only **c05**
James E. Steck and Kamran Rokhsaz *In its* Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

The possibility was studied of the use of artificial neural networks to assist the pilot in performing super maneuvers. A three degree of freedom dynamic model was devised. Two such networks were used to ultimately learn to associate a specific type of stick motion with a predefined maneuver. One network was trained to predict the transient aerodynamic force and moment coefficients of a 70 deg delta wing. The accuracy of the predicted values of these coefficients was demonstrated: (1) by comparison of the results with experimental aerodynamic data; and (2) by comparison of the response of the dynamic model to the predicted values as well as those of experiment. In the next phase, the required aerodynamic control input schedule is determined for a specified maneuver. An arbitrary stick motion time history is associated with this schedule. A second neural network was trained to associate the two parameters over a range of reduced frequencies. The comparison of the input and the output of this network for these parameters shows very promising trends. However, at this point, the errors in the predicted values of the required control inputs appear to result in unacceptable errors in the aircraft motion precision. Author

N92-21511# Wichita State Univ., KS. Dept. of Aerospace Engineering.
THE FLIGHT SIMULATION FACILITY AT THE WICHITA STATE UNIVERSITY Abstract Only **c09**
Stephen G. McCauley *In its* Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

A flight simulation is currently being developed at the National Institute for Aviation Research in order to study a pilot's workload during terminal area operations. The simulator is a fixed base Learjet cockpit that has been outfitted with a 19 inch monitor for the outside scene visual displays and a 14 inch monitor used to display an instrument panel. A 32 button switch panel is also used to allow for the pilot interactions. The simulation is being performed by a network of computers. Current research on the simulator is the development of a highly interactive autopilot. This can perform as an autopilot or as a head-up display (HUD) showing the pilot what inputs to make. Various other HUD's have been developed and are being studied in order to determine whether the autopilot actually helps improve the pilot's performance. Future desired improvements and research include the addition of a wide screen visual display, force feedback controls, and an artificially intelligent co-pilot that could be voice activated. Author

N92-21512# Kansas Univ., Lawrence. Flight Research Lab.
THE EVALUATION OF FUNCTIONAL FIGHTER AGILITY METRICS USING OPTIMAL TRAJECTORY ANALYSIS TECHNIQUES Abstract Only **c05**
Wesley Ryan *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

An optimal trajectory simulation routine called Optimal Trajectories by Implicit Simulation (OTIS) was used to develop optimal time control histories to test the Combat Cycle Time metric. These optimal control time histories were input into six degree of freedom batch simulation of a generic F-18 aircraft to compare optimal to nonoptimal control inputs. By comparing the use of optimal control inputs to nonoptimal control inputs, it is shown that large reductions in Combat Cycle Time are possible when optimal inputs are used. Large reductions in the amount of energy lost during the maneuver are also possible. The methods used could be applied to any aircraft to determine the optimal control inputs that yield the fastest Combat Cycle Time for the aircraft. Author

N92-21513# Kansas Univ., Lawrence.
PRELIMINARY DESIGN AND LAY-OUT OF AN INFANT RESTRAINT SYSTEM Abstract Only **c03**
Antje Ellrott *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

Due to improper restraint systems, infants have died or suffered from serious injuries during airplane crashes. A crashworthy infant restraint system which will not inflict a monetary strain on the adults traveling with the infants needs to be developed. By developing a safe and economical restraint system, most children between the ages of 0-2 years will be able to survive airplane crashes. The study shows the preliminary layout of such a system and its possible installation in a plane. Author

N92-21514# Lear Jet Industries, Inc., Wichita, KS. Aerodynamics Div.
AERODYNAMIC DESIGN WITH CFD Abstract Only **c02**
Reuben M. Chandrasekharan *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

The application of computational fluid dynamics (CFD) to practical aerodynamic design is described. It is shown how an advanced CFD tool such as the Tranair transonic code can be used to shape airplane components, subject to structural constraints. Some aerodynamic improvements achieved on the Learjet Model 60 business jet using CFD are presented. Author

N92-21729* National Aeronautics and Space Administration, Washington, DC.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 273)
Jan. 1992 219 p
(NASA-SP-7037(273); NAS 1.21:7037(273)) Avail: NTIS HC A10; NTIS standing order as PB92-914100, A04 CSCL 01A

This bibliography lists 808 reports, articles, and other documents introduced into the NASA scientific and technical information system in Dec. 1991. Subject coverage includes: design, construction and testing of aircraft and aircraft engines; aircraft components, equipment, and systems; ground support systems; and theoretical and applied aspects of aerodynamics and general fluid dynamics. Author

N92-21834# Federal Aviation Administration, Washington, DC.
ADVISORY CIRCULAR: CORROSION CONTROL FOR AIRCRAFT
25 Jul. 1991 132 p Original contains color illustrations
(FAA-AC-43-4A) Avail: NTIS HC/MF A07; 24 functional color pages

Identification and treatment of corrosive attack on aircraft structure and engine materials is presented. Corrosion inspection frequency, corrosion identification, and corrosion treatment continues to be the responsibility of the operator and should be accomplished per this Advisory Circular (AC), the manufacturer's recommendations, or the operator's own maintenance program. The procedures presented in this AC are an acceptable means, but not the only acceptable means, of corrosion treatment. The information contained in this AC is applicable to aircraft for which the manufacturer has not published corrosion control information. Where the aircraft manufacturer has published a recommended corrosion inspection schedule and treatment program for a particular aircraft, that program should take precedence over the recommendations of this AC. Author

N92-21844* National Aeronautics and Space Administration, Washington, DC.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 272)
Dec. 1991 192 p
(NASA-SP-7037(272); NAS 1.21:7037(272)) Avail: NTIS HC A09; NTIS standing order as PB91-91400, A04 CSCL 01B

This bibliography lists 719 reports, articles, and other documents

introduced into the NASA scientific and technical information system in November, 1991. Subject coverage includes: design, construction and testing of aircraft and aircraft engines; aircraft components, equipment, and systems; ground support systems; and theoretical and applied aspects of aerodynamics and general fluid dynamics. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N92-21188*# Nielsen Engineering and Research, Inc., Mountain View, CA.
POSTFLIGHT AEROTHERMODYNAMIC ANALYSIS OF PEGASUS(TM) USING COMPUTATIONAL FLUID DYNAMIC TECHNIQUES Final Contractor Report
Gary D. Kuhn Mar. 1992 88 p Prepared in cooperation with PRC Kentron, Inc., Edwards, CA
(Contract NAS2-12722)
(NASA-CR-186017; H-1765; NAS 1.26:186017) Avail: NTIS HC/MF A05 CSCL 01A

The objective was to validate the computational capability of the NASA Ames Navier-Stokes code, F3D, for flows at high Mach numbers using comparison flight test data from the Pegasus (tm) air launched, winged space booster. Comparisons were made with temperature and heat fluxes estimated from measurements on the wing surfaces and wing-fuselage fairings. Tests were conducted for solution convergence, sensitivity to grid density, and effects of distributing grid points to provide high density near temperature and heat flux sensors. The measured temperatures were from sensors embedded in the ablating thermal protection system. Surface heat fluxes were from plugs fabricated of highly insulative, nonablating material, and mounted level with the surface of the surrounding ablative material. As a preflight design tool, the F3D code produces accurate predictions of heat transfer and other aerodynamic properties, and it can provide detailed data for assessment of boundary layer separation, shock waves, and vortex formation. As a postflight analysis tool, the code provides a way to clarify and interpret the measured results. Author

N92-21287# National Aerospace Lab., Tokyo (Japan). Aircraft Aerodynamics Div.
EVALUATION OF NACA0012 AIRFOIL TEST RESULTS IN THE NAL TWO-DIMENSIONAL TRANSONIC WIND TUNNEL
Norikazu Sudani, Hiroshi Kanda, Mamoru Sato, Hitoshi Miwa, Kenichi Matsuno, and Susumu Takanashi May 1991 18 p
(NAL-TR-1109T; ISSN-0389-4010) Avail: NTIS HC/MF A03

Surface pressure and drag measurements on the NACA0012 airfoil were conducted in the NAL Two-Dimensional Transonic Wind Tunnel. Using a comparison with other wind tunnel data, the wall interference effects are discussed, especially those from the sidewall. The results suggest that the Mach number of the actual flow around the airfoil is lower than the setting Mach number. The Mach number correction for the sidewall boundary layer effects based on the similarity rule was applied to the present measurements, thereby showing that the shock positions, the pressure distributions, and the minimum drag coefficients are in good agreement with both other wind tunnel results and the Navier-Stokes calculation. It is shown that the evaluation indicates satisfactory transonic airfoil test results in the NAL Two-Dimensional Transonic Wind Tunnel. Author

N92-21333# JAI Associates, Inc., Mountain View, CA.
FLOWFIELD ANALYSIS OF MODERN HELICOPTER ROTORS IN HOVER BY NAVIER-STOKES METHOD
G. R. Srinivasan, V. Raghavan, and E. P. Duque 17 Oct. 1991 20 p
(AD-A245011; ARO-27752.2-EG) Avail: NTIS HC/MF A03 CSCL 01/1

The viscous, three-dimensional, flowfields of UH60 and BERP rotors are calculated for lifting hover configurations using a Navier-Stokes computational fluid dynamics method with a view to understand the importance of planform effects on the airloads. In this method, the induced effects of the wake, including the interaction of tip vortices with successive blades, are captured as a part of the overall flowfield solution without prescribing any wake models. Numerical results in the form of surface pressures, hover performance parameters, surface skin friction and tip vortex patterns, and vortex wake trajectory are presented at two thrust conditions for UH60 and BERP rotors. Comparison of results for the UH60 model rotor show good agreement with experiments at moderate thrust conditions. Comparison of results with equivalent rectangular UH60 blade and BERP blade indicates that the BERP blade, with an unconventional planform, gives more thrust at the cost of more power and a reduced figure of merit. The high thrust conditions considered produce severe shock-induced flow separation for UH60 blade, while the BERP blade develops more thrust and minimal separation. The BERP blade produces a tighter tip vortex structure compared with the UH60 blade. These results and the discussion presented bring out the similarities and differences between the two rotors. GRA

N92-21356*# Eloret Corp., Palo Alto, CA.
INTERFEROGRAMS, SCHLIEREN, AND SHADOWGRAPHS CONSTRUCTED FROM REAL- AND IDEAL-GAS, TWO- AND THREE-DIMENSIONAL COMPUTED FLOWFIELDS
Leslie A. Yates [1992] 10 p
(Contract NCC2-583)
(NASA-CR-190054; NAS 1.26:190054) Avail: NTIS HC/MF A02 CSCL 01A

The construction of interferograms, schlieren, and shadowgraphs from computed flowfield solutions permits one-to-one comparisons of computed and experimental results. A method for constructing these images from both ideal- and real-gas, two- and three-dimensional computed flowfields is described. The computational grids can be structured or unstructured, and multiple grids are an option. Constructed images are shown for several types of computed flows including nozzle, wake, and reacting flows; comparisons to experimental images are also shown. In addition, the sensitivity of these images to errors in the flowfield solution is demonstrated, and the constructed images can be used to identify problem areas in the computations. Author

N92-21429 Rensselaer Polytechnic Inst., Troy, NY.
PRESSURE AND VELOCITY MEASUREMENTS ABOUT AN AIRFOIL DURING A PARALLEL BLADE-VORTEX INTERACTION Ph.D. Thesis
John Straus 1991 208 p
Avail: Univ. Microfilms Order No. DA9202213

Unsteady surface pressure and boundary layer velocity measurements were taken about an airfoil during a parallel blade-vortex interaction. It was necessary that the pressures and velocities were ensemble averaged. The pressures were integrated about the surface such that the effects of the blade-vortex interaction on the airfoil aerodynamics could be revealed. It was found that the total change in lift increased as the interaction distance decreased. It was also found that the effect of the interacting airfoil angle of attack had little effect when the vortex trajectory was taken into account. Furthermore, little difference was found between the results of an interaction with a clockwise vortex and a counter-clockwise vortex with the exception of sign change in the variation of lifts and moments. It was concluded that a leading edge separation occurred for the stronger interactions. Boundary layer velocity measurements were taken of a blade-vortex interaction of moderate intensity. It was found that the response of the boundary layer to the passing vortex was highly dependent upon the type of boundary layer. It was found that a boundary layer that is near transition in the steady-state will become fully turbulent during the interaction. A 'stable' laminar

profile was found to remain laminar, though an excessive amount of turbulent energy was still generated. Dissert. Abstr.

N92-21432*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CURRENT STATUS OF COMPUTATIONAL METHODS FOR TRANSONIC UNSTEADY AERODYNAMICS AND AEROELASTIC APPLICATIONS
John W. Edwards and John B. Malone Jan. 1992 26 p Presented at the AGARD Structures and Materials Panel Specialist's Meeting on Transonic Unsteady Aerodynamics and Aeroelasticity, San Diego, CA, 9-11 Oct. 1991
(NASA-TM-104191; NAS 1.15:104191; AGARD-Paper-1) Avail: NTIS HC/MF A03 CSCL 01A

The current status of computational methods for unsteady aerodynamics and aeroelasticity is reviewed. The key features of challenging aeroelastic applications are discussed in terms of the flowfield state: low-angle high speed flows and high-angle vortex-dominated flows. The critical role played by viscous effects in determining aeroelastic stability for conditions of incipient flow separation is stressed. The need for a variety of flow modeling tools, from linear formulations to implementations of the Navier-Stokes equations, is emphasized. Estimates of computer run times for flutter calculations using several computational methods are given. Applications of these methods for unsteady aerodynamic and transonic flutter calculations for airfoils, wings, and configurations are summarized. Finally, recommendations are made concerning future research directions. Author

N92-21456*# Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.
FLOW ANALYSIS AND DESIGN OPTIMIZATION METHODS FOR NOZZLE AFTERBODY OF A HYPERSONIC VEHICLE
Oktay Baysal Washington NASA. Langley Research Center Apr. 1991 57 p
(Grants NAG1-811; NAG1-1188)
(NASA-CR-4431; NAS 1.26:4431) Avail: NTIS HC/MF A04 CSCL 01A

This report summarizes the methods developed for the aerodynamic analysis and the shape optimization of the nozzle-afterbody section of a hypersonic vehicle. Initially, exhaust gases were assumed to be air. Internal-external flows around a single scramjet module were analyzed by solving the three dimensional Navier-Stokes equations. Then, exhaust gases were simulated by a cold mixture of Freon and Argon. Two different models were used to compute these multispecies flows as they mixed with the hypersonic airflow. Surface and off-surface properties were successfully compared with the experimental data. In the second phase of this project, the Aerodynamic Design Optimization with Sensitivity analysis (ADOS) was developed. Pre and post optimization sensitivity coefficients were derived and used in this quasi-analytical method. These coefficients were also used to predict inexpensively the flow field around a changed shape when the flow field of an unchanged shape was given. Starting with totally arbitrary initial afterbody shapes, independent computations were converged to the same optimum shape, which rendered the maximum axial thrust. Author

N92-21465*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
AN ALTERNATIVE TO UNSTRUCTURED GRIDS FOR COMPUTING GAS DYNAMIC FLOWS AROUND ARBITRARILY COMPLEX TWO-DIMENSIONAL BODIES Final Report
James J. Quirk Feb. 1992 32 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189612; NAS 1.26:189612; ICASE-92-7) Avail: NTIS HC/MF A03 CSCL 01A

In this paper we describe an approach for dealing with arbitrary complex, two dimensional geometries, the so-called cartesian boundary method. Conceptually, the cartesian boundary method is quite simple. Solid bodies blank out areas of a background, cartesian mesh, and the resultant cut cells are singled out for special attention. However, there are several obstacles that must be overcome in order to achieve a practical scheme. We present a general strategy that overcomes these obstacles, together with some details of our successful conversion of an adaptive mesh algorithm from a body-fitted code to a cartesian boundary code. Author

N92-21588* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MULTI-COLORED LAYERS FOR VISUALIZING AERODYNAMIC FLOW EFFECTS Patent
Ronald N. Jensen, inventor (to NASA) 10 Dec. 1991 3 p Filed 3 Dec. 1990 Supersedes N91-16999 (29 - 9, p 1273)
(NASA-Case-LAR-13742-1; US-Patent-5,070,729; US-Patent-Appl-SN-621144; US-Patent-Class-73-147; US-Patent-Class-116-201; US-Patent-Class-116-207; Int-Patent-Class-G01M-9/00) Avail: US Patent and Trademark Office CSCL 01A

A method is provided for visualizing aerodynamic flow effects on a test surface. First, discrete quantities of a sublimating chemical such as naphthalene are distinctively colored via appropriate dyes or paints. Next, a uniform layer of the sublimating chemical having a particular color is applied to the test surface. This layer is covered with a second uniform layer of a different colored sublimating chemical, and so on until a composite of multi-colored layers is formed having a discrete thickness. Friction caused by an airflow results in the distinctly colored layers being removed in proportion to such aerodynamic flow characteristics as velocity and temperature, resulting in a multi-colored portrait which approximates the air flow on the underlying test surface.
Official Gazette of the U.S. Patent and Trademark Office

N92-21703# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
THREE-DIMENSIONAL SIMULATIONS OF HYPERSONIC FLOWS
Michael Pfitzner, W. Schroeder, S. Menne, and Claus Weiland 4 Sep. 1991 15 p Presented at International Conference on Hypersonic Aerodynamics, Manchester, England, 4-6 Sep. 1989 Previously announced in IAA as A91-21184
(MBB-UK-0155-89-PUB; ETN-92-90998) Avail: NTIS HC/MF A03

Flow codes for the simulation of three dimensional hypersonic flows are presented. The equilibrium real gas flow about a reentry configuration and about a two stage reusable launch vehicle is simulated by a code based on the quasi conservative form of the Euler equations in conjunction with a bow shock fitting algorithm and a Runge-Kutta time stepping scheme. Imbedded shocks are captured. Flows about more complicated geometries containing very strong shocks are simulated using a code based on a symmetric TVD discretization and explicit and implicit time integration. ESA

N92-21753# Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
IDENTIFICATION OF AERODYNAMIC COEFFICIENTS USING COMPUTATIONAL NEURAL NETWORKS
Dennis J. Linse and Robert F. Stengel 9 Jan. 1992 13 p Presented at the Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992 Previously announced in IAA as A92-23783
(Contract DAAL03-89-K-0092)
(AD-A244711; ARO-25264.13-MA) Avail: NTIS HC/MF A03 CSCL 01/1

Precise, smooth aerodynamic models are required for implementing adaptive, nonlinear control strategies. Accurate representations of aerodynamic coefficients can be generated for the complete flight envelope by combining computational neural network models with an Estimation-Before-Modeling paradigm for on-line training information. A novel method of incorporating first-partial-derivative information is employed to estimate the weights in individual feedforward neural networks for each aerodynamic coefficient. The method is demonstrated by generating a model of the normal force coefficient of a twin-jet transport

aircraft from simulated flight data. Promising results were obtained. GRA

N92-21784# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Aerodynamics.
TWO-DIMENSIONAL TRANSONIC FLOW CALCULATION BY INTERACTION OF EULER AND BOUNDARY LAYER EQUATIONS
Z. Ziqiang and T. Siikonen 26 Oct. 1990 44 p
(PB92-136449; SER-B-90-B27; ISBN-951-22-0389-8) Avail: NTIS HC/MF A03 CSCL 01A

A viscous/inviscid interaction calculation, based on the Euler and inverse boundary layer equations, is described for computing transonic flows over airfoils. The Euler method is modified to include a prescribed surface transpiration flux distribution obtained from the inverse boundary layer method, which allows calculation of flows with separation. Solutions are presented for airfoils with relatively strong shocks and with separation. The results show good agreement with experimental data. GRA

N92-21504# Kansas Univ., Lawrence. Flight Research Lab.
ACTIVE FLOW CONTROL FOR TWENTY-FIRST CENTURY HIGH-PERFORMANCE AIRCRAFT WITH APPLICATIONS TO LAND AND SEA VEHICLES Abstract Only
Saeed Farokhi *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

N92-21514# Lear Jet Industries, Inc., Wichita, KS. Aerodynamics Div.
AERODYNAMIC DESIGN WITH CFD Abstract Only
Reuben M. Chandrasekharan *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

N92-21528*# General Electric Co., Cincinnati, OH.
INLET TECHNOLOGY
Paul Kutschenreuter *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 6 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N92-21379# Cranfield Inst. of Tech., Bedford (England). Air Transport Group.
CANADA'S AIRLINE DUOPOLY: IS IT AN OPTIMUM STRATEGY IN A GLOBALIZED, COMMODITIZED AIR TRANSPORT ENVIRONMENT? Thesis
Robert N. Freedman 1991 125 p
(ISBN-0-9694473-1-0; CTN-92-60412) Copyright Avail: NTIS HC/MF A06

Economic, political, and geographical pressures are causing airlines to rethink their objectives for long-term survivability due to a changing environment. Three important events are changing international aviation markets in the nineties: the European single market, the continuation of immense growth in the Pacific, and the development of long range aircraft with acceptable economics. The current duopoly in Canada suggests that economic forces have allowed only a few firms to serve the marketplace profitably. Concentration has occurred by mergers and takeovers which took place, prior and during the deregulation phase that was formally introduced in 1988. In determining an optimum strategy for the Canadian airlines, one must consider the implications for all parties concerned, in terms of use and regulation. This report examines the Canadian situation in a global marketplace, and recommends a future strategy to compete more effectively in a globalized marketplace, while trying to balance the wants and needs of all parties. A number of strategy options suggested highlight methods of achieving efficiencies that are present within the Canadian air transport market. Overcoming the political obstacles is necessary for future strategy implementation. Only through cooperation and coordination by governments, consumers, and airlines can a beneficial option be achieved. It is suggested that in the end, a compromise by each of the parties involved, will be necessary to achieve stability in a rapidly changing and consolidating marketplace. Author (CISTI)

N92-21679# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel.
EFFECTS OF ADVERSE WEATHER ON AERODYNAMICS
Dec. 1991 287 p In ENGLISH and FRENCH Meeting held in Toulouse, France, 29 Apr. - 1 May 1991
(AGARD-CP-496; ISBN-92-835-0644-8) Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

This meeting was organized to provide a timely review of the progress being made in advancing the state of the art in predicting, simulating, and measuring the effects of icing, anti-icing fluids, and various forms of precipitation on the aerodynamic characteristics of flight vehicles. Topics included results from both theoretical and experimental programs and material related to procedures and regulations for certification and operation. International participation for the meeting included authors from eight nations and representatives from most of the 16 NATO nations. For individual titles, see N92-21680 through N92-21698.

N92-21680# Renaudie (J. F.), Versailles (France).
FLIGHT IN ADVERSE ENVIRONMENTAL CONDITIONS
J. F. Renaudie *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 21 p (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Brief accounts are given of a number of papers presented at the Flight Mechanics Panel (FMP) Symposium held in Gol, Norway May 8 to 11, 1989. Atmospheric measurements and modeling, the effect of disturbances on design and operations, visibility, aircraft icing, and electromagnetic disturbances are discussed. Author

N92-21681# Douglas Aircraft Co., Inc., Long Beach, CA.
THE EFFECT OF WING ICE CONTAMINATION ON ESSENTIAL FLIGHT CHARACTERISTICS
R. E. Brumby *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 4 p (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Contamination of critical aerodynamic surfaces by ice, frost, and/or snow has been identified as the probable cause of a significant number of aircraft accidents. In most cases, the ice contamination has not been large ice accretions on the leading edges or thick layers of adhering snow on top of the wings. Rather, dangerous reductions in stall margins and handling qualities can occur because of ice related roughness equivalent to that of medium-grit sandpaper. Described here are the typical effects of such roughness on lift, drag, and pitching moment, and the corresponding effects on longitudinal and lateral control characteristics during rotation and liftoff. Of great importance is that the visual, aural, and tactical clues signaling a developing critical situation occur within a very few seconds, and usually do not correspond to any for which the flight crew has been trained or has previously experienced. Author

N92-21682# Ecole Royale Militaire, Brussels (Belgium).
LOW TEMPERATURE ENVIRONMENT OPERATIONS OF TURBOENGINES (DESIGN AND USER'S PROBLEMS)

R. Jacques *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 12 p (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The author summarizes and links together a number of papers that were presented at the Propulsion and Energetics (PEP) symposium on low temperature environment operation of turbojet engines that was held October 8 to 12, 1990. Topics covered include operational experience of ice ingestion in the turboprop engine in the 2,000 hp class, icing on helicopter turbo engines, icing test facilities, ice relevant cloud physical parameters, and low temperature and fuel problems. Author

N92-21683# Centre d'Essais en Vol, Istres (France). Ingenieur Navigant d'Essais.
REGULATIONS AND THEIR CHANGES FOR CERTIFICATION OF CIVIL AIRCRAFT IN ICING CONDITIONS [EVOLUTION REGLEMENTAIRE EN MATIERE DE CERTIFICATION DES AVIONS CIVILS EN CONDITIONS GIVRANTES]
Gilbert Cattaneo *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 9 p In FRENCH (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Experience acquired in the process of certifying standards and service use of civil aircraft has shown that a change of regulations is necessary. The regulatory changes in maintaining a safety level during flight in icing conditions that are comparable to flight in conditions where no icing is possible are discussed. Author

N92-21684*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ICING SIMULATION: A SURVEY OF COMPUTER MODELS AND EXPERIMENTAL FACILITIES
M. G. Potapczuk and J. J. Reinmann *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 27 p Previously announced as N91-23087 (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive CSCL 01C

A survey of the current methods for simulation of the response of an aircraft or aircraft subsystem to an icing encounter is presented. The topics discussed include a computer code modeling of aircraft icing and performance degradation, an evaluation of experimental facility simulation capabilities, and ice protection system evaluation tests in simulated icing conditions. Current research focused on upgrading simulation fidelity of both experimental and computational methods is discussed. The need for the increased understanding of the physical processes governing ice accretion, ice shedding, and iced aerodynamics is examined. Author

N92-21685# Aerospatiale, Toulouse (France). Div. Avions.
METHOD FOR CALCULATING THE THREE-DIMENSIONAL WATER CONCENTRATION COEFFICIENTS AND ITS INDUSTRIAL APPLICATIONS [METHODE DE CALCUL DE COEFFICIENTS DE CONCENTRATION D'EAU EN TRIDIMENSIONNEL ET SES APPLICATIONS INDUSTRIELLES] **c34**
P. Prel *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 12 p In FRENCH (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

A three dimensional method for calculating the concentration coefficients of water droplets, its general principles, as well as the details of the calculating computer programs that were used, are described. The applications are presented for locating probes on the Airbus 340 and ATR 72 airplanes, mainly showing the effect of the drop diameter on the measured concentration. Author

N92-21686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SIMULATION OF ICED WING AERODYNAMICS
M. G. Potapczuk, M. B. Bragg, O. J. Kwon, and L. N. Sankar (Georgia Inst. of Tech., Atlanta.) *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 15 p Previously announced as N91-23086 (For primary document see N92-21679 12-03)
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The sectional and total aerodynamic load characteristics of moderate aspect ratio wings with and without simulated glaze leading edge ice were studied both computationally, using a three dimensional, compressible Navier-Stokes solver, and experimentally. The wing has an untwisted, untapered planform shape with NACA 0012 airfoil section. The wing has an unswept and swept configuration with aspect ratios of 4.06 and 5.0. Comparisons of computed surface pressures and sectional loads with experimental data for identical configurations are given. The abrupt decrease in stall angle of attack for the wing, as a result of the leading edge ice formation, was demonstrated numerically and experimentally. Author

N92-21687# Carleton Univ., Ottawa (Ontario). Dept. of Mechanical and Aerospace Engineering.
EFFECTS OF FROST ON WING AERODYNAMICS AND TAKE-OFF PERFORMANCE
R. J. Kind and M. A. Lawrysyn *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 11 p (For primary document see N92-21679 12-03)
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Computations were done to predict the effects of various extents of frost coverage on the airfoil, wing, and takeoff performance of two hypothetical aircraft, a small light aircraft and a large transport aircraft. Airfoil performance was computed using rough wall boundary layer calculations coupled to an inviscid vortex panel method which includes a capacity for modeling stalled flow conditions. The roughness parameters determined for one of the frost samples were used for this purpose. A lifting line analysis was used to determine wing performance from the airfoil results. The results indicate that frost having an effective height of only 0.4 mm in the leading edge region of a wing can cause serious performance degradation even for a very large aircraft. On the other hand, frost coverage beginning well down stream of the suction peak, for example at about one/quarter chord, was predicted to have little effect. Author

N92-21688*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MODEL ROTOR ICING TESTS IN THE NASA. LEWIS ICING RESEARCH TUNNEL
Robert J. Flemming, Randall K. Britton (Sverdrup Technology, Inc., Brook Park, OH.), and Thomas H. Bond *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 25 p Previously announced as N91-23184 (For primary document see N92-21679 12-03)
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Tests of a lightly instrumented two bladed teetering rotor and a heavily instrumented subscale articulated main rotor were conducted in the NASA Lewis Icing Research Tunnel (IRT). The first was an OH-58 tail rotor which had a diameter of 1.575 m and a blade chord of 0.133 m, and was mounted on a NASA designed test rig. The second, a four bladed articulated rotor, had a diameter of 1.83 m with 0.124 m chord blades specifically fabricated for the experiment. This rotor was mounted on a Sikorsky Aircraft Powered Force Model, which enclosed a rotor balance and other measurement systems. The models were exposed to variations in temperature, liquid water content, and medium droplet diameter, and were operated over ranges of advance ratio, shaft

angle, tip Mach number (rotor speed), and weight coefficient to determine the effect of these parameters on ice accretion. In addition to strain gage and balance data, the test was documented with still, video, and high speed photography, ice profile tracing, and ice molds. The sensitivity is presented of the model rotors to the test parameter and a comparison of the results to theoretical predictions. Author

N92-21689# Royal Aerospace Establishment, Farnborough (England).
A REVIEW OF ICING RESEARCH AT THE ROYAL AEROSPACE ESTABLISHMENT
R. W. Gent *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 15 p (For primary document see N92-21679 12-03)
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A brief review of the computer models developed by the Royal Aerospace Establishment (RAE) for the analysis of natural rotor icing and rotor protection against icing is provided. Experimental results are then presented for the increase in profile drag due to rime, glaze, and beak type icing. These data, combined with other published data, were used to obtain correlations for iced profile performance which were included in a computer model of helicopter performance. This enables the prediction of the increase in rotor power required by a helicopter with unprotected rotors during flight in icing conditions. Comparisons between model prediction and both rig and flight test data are given. K.S.

N92-21690# National Research Council of Canada, Ottawa (Ontario). Applied Aerodynamics Lab.
WIND TUNNEL INVESTIGATION OF A WING-PROPELLER MODEL PERFORMANCE DEGRADATION DUE TO DISTRIBUTED UPPER-SURFACE ROUGHNESS AND LEADING EDGE SHAPE MODIFICATION
R. H. Wickens and V. D. Nguyen *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 19 p (For primary document see N92-21679 12-03)
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A wind tunnel investigation has assessed the effects of distributed upper surface roughness, and leading edge ice formation on a powered wing propeller model. In the unpowered state, it was found that roughness reduces the lift slope, and maximum lift by 30 to 50 percent, depending upon particle size and Reynolds number. The leading edge region is especially sensitive to these disturbances, however, removal of the toughness over a small portion of the nose restored the wing to close to its original performance. The application of power to the wing, with an increase of slipstream dynamic pressure increases the lift slope and maximum lift; however, removal of the roughness over a small portion of the nose restored the wing to close to its original performance. The application of power to the wing, with an increase of slipstream dynamic pressure increases the lift slope and maximum lift; however, this benefit is lost if the wing is roughened. Subtraction of the propeller reactions indicated that the slipstream interaction accounted for half the lift increase, and also resulted in reduced drag for the clean surface. This drag reduction was removed when the wing was roughened, indicating that the degradation of wing performance due to roughening is relatively greater when a slipstream is presented, compared to the unpowered wing. Leading edge ice accretion causes similar large losses in lift and increases of form drag although a comparison of the two types of contamination showed that leading edge ice produces a smaller reduction of lift slope prior to flow separation. In both types of contamination, Reynolds number is important, and emphasizes the necessity of testing under near full-scale conditions. K.S.

N92-21691*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE ADVERSE AERODYNAMIC IMPACT OF VERY SMALL LEADING-EDGE ICE (ROUGHNESS) BUILDUPS ON WINGS AND TAILS
Frank T. Lynch, Walter O. Valarezo (Douglas Aircraft Co., Inc., Long Beach, CA.), and Robert J. McGhee *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 8 p (For primary document see N92-21679 12-03)
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Systematic experimental studies were performed to establish the aerodynamic impact of very small leading-edge simulated ice (roughness) formations on lifting surfaces. The geometries studied include single element configurations (airfoil and 3-D tail) as well as multi-element high-lift airfoil geometries. Emphasis in these studies was placed on obtaining results at high Reynolds numbers to insure the applicability of the findings to full-scale situations. It was found that the well-known Brumby correlation for the adverse lift impact of discrete roughness elements at the leading edge is not appropriate for cases representative of initial ice build up (i.e., distributed roughness). It was also found that allowing initial ice formations of a size required for removal by presently proposed deicing systems could lead to maximum lift losses of approximately 40 percent for single-element airfoils. Losses in angle-of-attack margin to stall are equally substantial - as high as 6 degrees. Percentage losses for multi-element airfoils are not as severe as for single-element configurations, but degradations of the angle-of-attack-to-stall margin are the same for both. K.S.

N92-21692# Fokker B.V., Schipol-Oost (Netherlands). Aerodynamics and Aeroelasticity Dept.
THE EFFECT OF HOAR-FROSTED WINGS ON THE FOKKER 50 TAKE-OFF CHARACTERISTICS
J. vanHengst and J. N. Boer *In* AGARD, Effects of Adverse Weather an Aerodynamics Dec. 1991 9 p (For primary document see N92-21679 12-03)
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Reviewed here is how contamination resulting from ice, snow, or frost accumulated during ground icing degrades the Fokker 50 aircraft aerodynamics and leads to reduced flight safety during takeoff. From simulation tests it was concluded that wing contamination due to ground frost seriously deteriorates the aircraft behavior in takeoff, leading to reduced flight safety. A large increase in takeoff distance is experienced. No improvement was found from cleaning the wing leading edge only or by increasing rotation speed. The results clearly demonstrate the importance of Advisory Circular AC 20-117 emphasizing the 'clean aircraft concept' under adverse weather conditions before takeoff. Author

N92-21693# Dornier Luftfahrt G.m.b.H., Friedrichshafen (Germany, F.R.).
PREPARATION OF THE ICE CERTIFICATION OF THE DORNIER 328 REGIONAL AIRLINER BY NUMERICAL SIMULATION AND BY GROUND TEST
D. Welte, W. Wohlrath, R. Seubert, W. DiBartolomeo, and R. D. Toogood (Pratt and Whitney Aircraft of Canada Ltd., Longueuil, Quebec) *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 14 p (For primary document see N92-21679 12-03)
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The Dornier 328, a new regional airliner, is to be qualified to FAR25/JAR25 requirements for operation into known icing conditions. All lifting surfaces are pneumatically deiced. Impingement limits were determined using a validated computational fluid dynamic (CFD) code. Wind tunnel tests with a model of the whole aircraft and the isolated empennage equipped with artificial ice shapes showed a degradation of handling characteristics due to ice accretion. Extensive two and three dimensional CFD calculations evaluated ice accretion at the deflection elevator horn. Icing tunnel tests were performed with a

model of the horizontal tail with icing similitude fulfilled. The Dornier Do328 powerplant air induction system has successfully completed a program of icing tests in support of aircraft certification for operation into known icing conditions. Potential flight icing conditions were extensively analyzed using a CFD potential flow code and 3-D particle tracking routine to identify critical flight icing conditions. The tunnel test program verified the analytically predicted critical ice accretion surfaces of the air induction system, the adequacy of the ice protection provisions and demonstrated compliance with the applicable (JAR25) regulatory material.

Author

N92-21694*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

A SUMMARY OF NASA RESEARCH ON EFFECTS OF HEAVY RAIN ON AIRFOILS

Dana J. Dunham, R. Earl Dunham, Jr., and Gaudy M. Bezos *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 14 p (For primary document see N92-21679 12-03)

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Results from a broad NASA research program are presented. The intention of the program was to obtain fundamental aerodynamic information regarding the effect of heavy rain on airplane performance. The take-off and landing characteristics are of particular concern, and the aim of the program is to understand the physical phenomena associated with any aerodynamic performance penalty that may occur during a rain encounter. This overview includes results of recent attempts to measure high-intensity, short-duration rainfall, a discussion of some of the earlier analytical investigations of rain effects on airfoils, a review of some promising experimental methods for evaluating rain effects, and some important scaling considerations for extrapolating model data. D.R.D.

N92-21695# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain). Experimental Aerodynamics Lab.

THE MEASUREMENT OF WATER FILM THICKNESS ON AIRFOILS IN HEAVY RAIN CONDITIONS USING CONDUCTANCE SENSORS

A. Feo, F. Rogles, and M. Urdiales *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 14 p (For primary document see N92-21679 12-03)

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Calibration results of liquid film thickness using electric conductance sensors are presented. Two sensor types are analyzed. First, a double electrode sensor whose calibrations compensate liquid conductivity and secondly, a triple electrode sensor that, when properly calibrated, also compensates capacitive effects. For this second type, the electrolytic effects can also be corrected without excessive errors. Tests conducted on a large-scale airfoil under simulated heavy rain conditions, at NASA Langley Research Center are described, and the film thickness that develop, measured. Author

N92-21696# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.

EXPERIMENTAL INVESTIGATION OF HEAVY RAINFALL EFFECT ON A 2-D HIGH LIFT AIRFOIL

F. C. Tang *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 10 p (For primary document see N92-21679 12-03)

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The effects of simulated heavy rainfall on a 2D high lift airfoil were studied in a wind tunnel program. The experiment was carried out in the 2D test section of the 1.5 m x 1.5 m blowdown wind tunnel of the High Speed Aerodynamics Laboratory. The model used in the investigation was a modified NACA 65(sub 2)215 multi-element airfoil with a basic chord of 254 mm. The Mach number was fixed at M = 0.2, typical of the landing speed of transport type aircraft. The chord Reynolds number range was 1.7 to 8.8 x 10(exp 6). Measurements included lift, drag, and pitching moment of the airfoil obtained by side wall balances and the flow rate from a water spray manifold. The effects of the simulated rainfall to the airfoil performances are very significant. The loss in maximum lift coefficient ranged from 6 percent to a high of 16 percent. The drag levels at constant lift are up to 43 percent higher under wet conditions. A smaller performance degradation was noted when the model was stripped of the smooth epoxy paint with which it was originally finished. D.R.D.

N92-21697# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Aeronautics/Aerospace Dept.

AERODYNAMIC EFFECTS OF DE/ANTI-ICING FLUIDS AND DESCRIPTION OF A FACILITY AND TEST TECHNIQUE FOR THEIR ASSESSMENT

Mario Carbonaro *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 20 p (For primary document see N92-21679 12-03)

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Research carried out at the von Karman Institute, from 1984 to the present, on the subject of flow-off of aircraft de-icing and anti-icing fluids is presented. Additionally, a test methodology for the acceptance of anti- and de-icing fluids is described. D.R.D.

N92-21698# Boeing Commercial Airplane Co., Seattle, WA. Aerodynamics Div.

WIND TUNNEL INVESTIGATION OF THE AERODYNAMIC EFFECTS OF AIRCRAFT GROUND DEICING/ANTI-ICING FLUIDS AND CRITERIA FOR AERODYNAMIC ACCEPTANCE

Thomas A. Zierten and Eugene G. Hill *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 8 p (For primary document see N92-21679 12-03)

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A follow-on wind tunnel investigation of the aerodynamic effects of aircraft ground deicing/anti-icing fluids was performed to supplement earlier reported flight and wind tunnel tests and support the development of aerodynamic acceptance criteria for aircraft ground deicing/anti-icing fluids. The test was conducted at the NASA Lewis Research Center Icing Research Tunnel using both a 2D model and a 3D half model of the 737-200ADV airplane. The fluids that were tested included the following: three Type I Newtonian fluids, which use ethylene, diethylene, and propylene glycol as the freezing point depressant; four Type II non-Newtonian fluids, which are currently in production; eight developmental fluids; and a Mil Spec fluid to be used as a reference fluid in the aerodynamic acceptance test. The Type I and current Type II fluids were tested neat and diluted to determine basic aerodynamic effects. Dilution of the Type II fluids did not significantly alter the aerodynamic effects of the fluids. Diluting the Type I fluids did result in a significant reduction in the adverse aerodynamic effects of these fluids, especially at temperatures of -10 C and colder. Boundary layer displacement thickness, delta*, measurements made with the fluids on the 2D model show excellent correlation with lift loss due to the fluids at maximum lift and at operating angles of attack and with the boundary layer displacement thickness measured on a flat plate in the small von Karman Institute wind tunnel. This correlation validated the future use of flat plate boundary layer displacement thickness measurement as the criterion for the aerodynamic acceptability of a fluid. The limiting boundary layer displacement thickness, which identifies a fluid as being aerodynamically acceptable, is correlated with a loss in maximum lift that results in an allowed specific reduction in aerodynamic performance margins. D.R.D.

N92-21746 Civil Aviation Authority, London (England).

UK AIRMISSES INVOLVING COMMERCIAL AIR TRANSPORT: SEPTEMBER - DECEMBER 1990

Jul. 1991 44 p

(ISSN-0951-6301; ETN-92-91050) Copyright Avail: Civil

Aviation Authority, Greville House, 37 Gratton Road, Cheltenham, England

United Kingdom (UK) airmisses are reported. The origin of an airmiss, the purpose and investigation of airmiss reports, the categories of airmisses, the involvement of commercial air transport traffic, and airmisses related to flying hours are discussed. Airmiss reports for Sep. to Dec. 1990 are given. Statistics in commercial transport airmisses are presented. ESA

N92-21833# National Transportation Safety Board, Washington, DC.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT U.S. CIVIL AND FOREIGN AVIATION ISSUE NUMBER 5 OF 1989 ACCIDENTS
18 Dec. 1990 407 p
(PB90-916905; NTSB/AAB-90/05) Avail: NTIS HC/MF A18; paper copy available on Standing Order, deposit account required (minimum deposit $100 U.S., Canada, and Mexico; all others $200) CSCL 01C

Given here are selected aircraft reports in brief format for U.S. civil and foreign aviation operations in Calendar Year 1989. The approximately 200 general aviation and air carrier accidents included here represent a random selection. The facts, conditions, circumstances, and probable causes for each accident are given. Author

N92-21838# National Transportation Safety Board, Washington, DC.
AIRCRAFT ACCIDENT REPORT: FUEL FARM FIRE AT STAPLETON INTERNATIONAL AIRPORT, DENVER, COLORADO, NOVEMBER 25, 1990
1 Oct. 1991 78 p
(PB91-910408; NTSB/AAR-91/07) Avail: NTIS HC/MF A05; paper copy available on Standing Order, deposit account required (minimum deposit $100 U.S., Canada, and Mexico; all others $200) CSCL 01C

On Sunday, November 25, 1990, a fire erupted at the fuel storage and dispensing facility about 1.8 miles from the main terminal of Stapleton International Airport at Denver, Colorado. The facility, referred to as a fuel farm, was operated by United Airlines and Continental Airlines. The fire burned for about 48 hours. Of the 5,185,000 gallons of fuel stored in tanks at the farm before the fire, about 3 million gallons were either consumed by the fire or lost as a result of leakage from the tanks. Total damage was estimated by United Airlines to have been between 15 and 20 million dollars. No injuries or fatalities occurred as a result of the fire. Author

N92-21873# National Transportation Safety Board, Washington, DC.
AIRCRAFT ACCIDENT REPORT: UNSTABILIZED APPROACH AND LOSS OF CONTROL NPA, INC. DBA UNITED EXPRESS FLIGHT 2415, BRITISH AEROSPACE BA-3101, N41OUE, TRI-CITIES AIRPORT, PASCO, WASHINGTON, DECEMBER 26, 1989
4 Nov. 1991 68 p
(PB91-910406; NTSB/AAR-91/06) Avail: NTIS HC/MF A04; paper copy available on Standing Order, deposit account required (minimum deposit $100 U.S., Canada, and Mexico; all others $200) CSCL 01C

On December 26, 1989, United Express, Flight 2415 (Sundance 415), a British Aerospace BA-3101 Jetstream, N41OUE, crashed approximately 400 feet short of runway 21R at Tri-Cities Airport, Pasco, Washington. The airplane crashed while executing an instrument landing approach to the runway. The airplane was destroyed and the two pilots and all four passengers received fatal injuries. Author

N92-21503*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COCKPIT WEATHER INFORMATION NEEDS Abstract Only
Charles H. Scanlon *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 2 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01C

N92-21508# Wichita State Univ., KS. National Inst. for Aviation Research.
THE AIRLINE QUALITY RATING: AN EXAMPLE OF ISSUE-BASED RESEARCH AT THE NATIONAL INSTITUTE FOR AVIATION RESEARCH Abstract Only
Dean Headley and Brent Bowen *In its* Techfest 18 Proceedings Jan. 1992 2 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

N92-21513# Kansas Univ., Lawrence.
PRELIMINARY DESIGN AND LAY-OUT OF AN INFANT RESTRAINT SYSTEM Abstract Only
Antje Ellrott *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N92-21201# Oak Ridge National Lab., TN.
TERRAIN FOLLOWING OF ARBITRARY SURFACES USING A HIGH INTENSITY LED PROXIMITY SENSOR
J. E. Baker Jan. 1992 26 p
(Contract DE-AC05-84OR-21400)
(DE92-007161; ORNL/TM-11991; CESAR-92/01) Avail: NTIS HC/MF A03

Many robotic operations, e.g., mapping, scanning, feature following, etc., require accurate surface following of arbitrary targets. This paper presents a versatile surface following and mapping system designed to promote hardware, software and application independence, modular development, and upward expandability. These goals are met by a full, a priori specification of the hardware and software interfaces; a modular system architecture; and a hierarchical surface-data analysis method, permitting application specific tuning at each conceptual level of topological abstraction. This surface following system was fully designed independently of any specific robotic host, then successfully integrated with and demonstrated on a completely a priori unknown, real-time robotic system. DOE

N92-21263# Coast Guard Academy, New London, CT. Center for Advanced Studies.
MEASUREMENT OF LORAN-C ENVELOPE TO CYCLE DIFFERENCE IN THE FAR FIELD Final Report
B. B. Peterson, T. N. Thomson, and J. Riffe Sep. 1991 13 p
(PB92-128909; USCGA-TR-2-91) Avail: NTIS HC/MF A03 CSCL 17G

With continent expansion and increased use of LORAN over extensive land paths by both aviation and terrestrial users, there has been renewed interest in the prediction and measurement of Envelope to Cycle Difference (ECD) in the far field. A number of relevant issues in the measurement of ECD are discussed. These include modelling of the far field pulse, analysis and calibration of the receiver front end, the algorithm used for calculation of ECD and the statistics of the measurements as a function of the signal to noise ratio and the noise model. Via network analysis, the magnitude and the phase of the frequency response of the receiver is measured and used to create a computer model of the front end. Calibration of the front end is accomplished by supplying an ideal LORAN pulse of varying ECD as the input of the model, measuring the output, and applying a conversion curve in the

algorithm. Issues such as receiver bandwidth, order, and the waveform samples used for ECD calculation are discussed. The statistics of the measurement process are examined in detail. Examples of bias due to cross rate interference and procedures for calculating the bias are presented. Author

N92-21279# Coast Guard Academy, New London, CT. Center for Advanced Studies.
PROBABILITY OF CYCLE JUMPS IN OMEGA RECEIVERS AND OTHER PHASE LOCKED LOOP APPLICATIONS
B. B. Peterson and W. H. Jones Nov. 1991 15 p
(PB92-128891; USCGA-TR-6-91) Avail: NTIS HC/MF A03
CSCL 17G

A study of cycle jumps in phase locked loops with a particular emphasis on Omega receivers is presented. Theoretical predictions using numerical integration of the probability density functions of the phase estimates for both Gaussian and more accurate noise models are presented. These theoretical results are validated through computer and hardware simulations using both Gaussian and atmospheric noise. Hard limited and linear receivers are considered along with various methods of phase estimate averaging. In addition, the combined effect of noise and errors in the velocity or phase estimates are presented. The results relating the probability of cycle jumps to signal to noise ratio (SNR) show very pronounced thresholding in Gaussian Noise, i.e., very small changes in the SNR can mean the difference between acceptable and unacceptable probability of cycle jumps. This was found not to be true for atmospheric noise due to the significant number of outliers even for large SNR's. The data supports a conclusion that the lower limit on acceptable SNR for receiver operation is due to the probability of receiver cycle errors and not merely fix in accuracy due to noise in lines of position. Author

N92-21404# Computer Technology Associates, Inc., McKee City, NJ.
EVALUATION OF TRIPLE SIMULTANEOUS PARALLEL ILS APPROACHES SPACED 5000 FEET APART, PHASE 4.B Test Report, Sep. 1990 - Nov. 1991
L. Hitchcock, T. Fischer, L. W. Bensel, G. Yastrop, R. Jones, R. Luongo, K. Reardon, and B. Startzel-Dehel Jan. 1992 77 p
(Contract DTFA03-89-C-00023)
(DOT/FAA/CT-91/31) Avail: NTIS HC/MF A05

Plans for increasing air traffic capacity and the feasibility are evaluated of using multiple simultaneous, parallel, Instrument Landing System (ILS) approaches. The objective was to evaluate the ability of experienced controllers to handle approach traffic during Instrument Meteorological Conditions (IMC) to a proposed parallel runway airport configuration, using a real time, interactive, air traffic control (ATC) simulation. This simulation used a current radar system, Airport Surveillance Radar (ASR-9), and a current display system, Automated Radar Terminal System (ARTS) IIIA. Triple simultaneous parallel ILS approaches were simulated with controllers monitoring traffic on the approach localizers. To challenge the system, blunders were introduced, according to predetermined scenarios, by having some of the simulated aircraft deviate from the localizer by either 10, 20, or 30 degs. The results indicated that controllers were able to resolve 99 pct. of the blunders initiated in the simulation. It was determined that triple simultaneous parallel ILS approach operations spaced at 5000 ft are acceptable using the ASR-9 radar and the ARTS IIIA displays. Author

N92-21459*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FLIGHT DECK BENEFITS OF INTEGRATED DATA LINK COMMUNICATION
Marvin C. Waller Washington NASA. Langley Research Center Apr. 1992 49 p
(NASA-TP-3219; L-16845; NAS 1.60:3219) Avail: NTIS HC/MF A03 CSCL 17G

A fixed-base, piloted simulation study was conducted to determine the operational benefits that result when air traffic control (ATC) instructions are transmitted to the deck of a transport aircraft over a digital data link. The ATC instructions include altitude, airspeed, heading, radio frequency, and route assignment data. The interface between the flight deck and the data link was integrated with other subsystems of the airplane to facilitate data management. Data from the ATC instructions were distributed to the flight guidance and control system, the navigation system, and an automatically tuned communication radio. The co-pilot initiated the automation-assisted data distribution process. Digital communications and automated data distribution were compared with conventional voice radio communication and manual input of data into other subsystems of the simulated aircraft. Less time was required in the combined communication and data management process when data link ATC communication was integrated with the other subsystems. The test subjects, commercial airline pilots, provided favorable evaluations of both the digital communication and data management processes. Author

N92-21839 Rensselaer Polytechnic Inst., Troy, NY.
AN INVESTIGATION OF THE ENERGY LOSS AND NEAR WAKE FLOW FIELD OF TRAILING EDGE INJECTION Ph.D. Thesis
Federico D. Liberatore 1991 189 p
Univ. Microfilms Order No. DA9202191

An investigation was conducted on the energy losses caused by three different gas turbine blade trailing edge geometries which featured forced injection cooling. The wake was three dimensional behind two models (patterned after industrial designs) and two dimensional behind the third trailing edge. Energy losses of the test body were subdivided into losses on the portion of the trailing edge and losses on the trailing edge. The losses at the trailing edges of all three models were found to be typically an order of magnitude greater than the losses on the portion forward of the trailing edge. Significant variation in the performance of the three geometries with changes in secondary stream blowing was found. Dissert. Abstr.

N92-21509# Nebraska Univ., Omaha. Inst. of Aviation.
COOPERATIVE PLANNING IN AVIATION CONTEXTS Abstract Only
C. Elaine McCoy *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

N92-21957# Naval Air Test Center, Patuxent River, MD.
ENHANCED DISPLAYS, FLIGHT CONTROLS, AND GUIDANCE SYSTEMS FOR APPROACH AND LANDING
R. W. Huff and G. K. Kessler *In* AGARD, Aircraft Ship Operations Nov. 1991 22 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21958# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INTEGRATION OF FLIGHT AND CARRIER LANDING AID SYSTEMS FOR SHIPBOARD OPERATIONS
B. Dang Vu, T. LeMoing, and P. Costes *In* AGARD, Aircraft Ship Operations Nov. 1991 15 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21959# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
APPROACH AND LANDING ASSISTED BY ONBOARD IMAGE PROCESSING [APPROCHE ET APPONTAGE ASSISTES PAR TRAITEMENT D'IMAGE EMBARQUE SUR AERONEF]
Y. LeGuilloux *In* AGARD, Aircraft Ship Operations Nov. 1991 10 p In FRENCH (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21960# Royal Aerospace Establishment, Bedford (England).
APPROACH AND LANDING GUIDANCE
A. J. Smith and E. J. Guiver *In* AGARD, Aircraft Ship Operations Nov. 1991 15 p (For primary document see N92-21951 12-05)
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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

N92-21208*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
FINAL DESIGN PROPOSAL: ZETA GROUP-VALKYRIE. A PROPOSAL IN RESPONSE TO A COMMERCIAL AIR TRANSPORTATION STUDY
May 1991 106 p Sponsored in part by Boeing Commercial Airplane Co.
(Contract NASw-4435)
(NASA-CR-190003; NAS 1.26:190003) Avail: NTIS HC/MF A06 CSCL 01C

The Valkyrie flying wing concept is a remotely piloted technology demonstrator designed to serve as a high volume commuter transport in Aeroworld. The 5.02 lb Valkyrie has a planform area of 1440 sq in and a wingspan of 84 in, which results in an aspect ratio of 4.9. The Valkyrie uses the NACA 2R(2)12 airfoil section. A leading edge wing sweep of 13.2 deg and a 2 deg dihedral were incorporated to provide lateral stability. The Valkyrie is semi-monocoque structure manufactured from spruce and balsa wood covered in plastic Mylar skin. The AstroFlight Cobolt 25 electric engine will power the Valkyrie with a Tornado 10-6 propeller. The Valkyrie is designed to take off in less than 20 ft. To eliminate the difficulties associated with rotating the aircraft at takeoff, the wing is mounted on its landing gear at the take off angle of attack of 8 deg. The Valkyrie provides a greater payload to weight ratio than a conventionally configured aircraft of comparable weight. Considering the requirements, the Valkyrie is the most efficient design for the specified mission. Author

N92-21210# Federal Aviation Administration, Washington, DC. Vertical Flight Program Office.
FAA VERTICAL FLIGHT RESEARCH, ENGINEERING, AND DEVELOPMENT BIBLIOGRAPHY, 1962 - 1991
Robert D. Smith and Michelle Vaughn (Systems Control Technology, Inc., Arlington, VA.) Mar. 1992 270 p
(Contract DTFA01-87-C-00014)
(FAA/ARD-30; DOT/FAA/RD-92/1) Avail: NTIS HC/MF A12

A bibliography of FAA vertical flight research and development reports published from 1962 to 1991 is presented. Abstracts for approximately 300 reports are included along with various indexes to help identify specific documents of interest. This bibliography was assembled as an aid to those who are interested in research, engineering, and development of vertical flight issues including heliports, vertiports, helicopters, tiltrotor, and tiltwing vehicles. The intended audience includes people within the Federal Aviation Administration (FAA), in industry, and in state and local governments. In selecting technical reports to be included in the bibliography, two limitations were observed. First, the reports are specifically related, in whole or in part, to vertical flight issues. Second, they are limited to reports in which the research, engineering, and development elements of the FAA were involved as sponsors, participants, or authors. Author

N92-21368# Naval Postgraduate School, Monterey, CA.
STORE SEPARATION METHODOLOGY ANALYSIS M.S. Thesis
Darcy M. Hansen Sep. 1991 81 p
(AD-A245148) Avail: NTIS HC/MF A05 CSCL 01/3

Various computational methods and operational computer codes used to predict the aerodynamic coefficients and separation trajectories of aircraft stores are examined. The semi-empirical aeroprediction code Missile DATCOM is used to obtain the coefficients of a modeled store. These coefficients, together with the modeled ejection forces, are used in free-stream state-space equations of motion to predict the store trajectory. The results are compared with the Nielson Engineering and Research (NEAR) store separation code which provides accurate trajectory profiles, for speeds below the subsonic Mach critical speed, by use of a vortex-lattice and panel method. Modification of the Missile DATCOM aerodynamic coefficients provides single-point state-space prediction of the store pitch trajectory to within 30 pct. of the NEAR code values. Store trajectories were restricted to the first 0.2 seconds of free-flight. GRA

N92-21373*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
FINAL DESIGN PROPOSAL: THETA GROUP-THE HOTBOX. A PROPOSAL IN RESPONSE TO A COMMERCIAL AIR TRANSPORTATION STUDY
May 1991 104 p Sponsored in part by Boeing Commercial Airplane Co.
(Contract NASw-4435)
(NASA-CR-190132; NAS 1.26:190132) Avail: NTIS HC/MF A06 CSCL 01C

The Hotbox is a 40 passenger commercial aircraft designed to have a minimum range of 5500 ft and cruise at a velocity of 30 ft/sec. The aircraft is designed to serve the longer range overseas market in Aeroworld. In order to serve all the airports in the overseas market, the Hotbox was required to be able to use a five foot gate. A weight requirement was set a 4.5 lbs in order to maximize aircraft efficiency. Finally, a single engine system was chosen because it minimized system weight, complexity and cost. The Hotbox is estimated to cost $152,000 Aeroworld dollars and will sell for $200.000. The propulsion system for the Hotbox consists of a nose mounted Astro 15 electric powered motor and a Top Flight 12-6 propeller. A Spica airfoil was selected for the Hotbox based on the ease of construction of its flat bottom and its positive lift and drag characteristics. A fuselage of rectangular cross section will internally contain the propulsion system, control system, and a passenger bay with 2x20 seating. A combination of directional and longitudinal control will enable the Hotbox to maneuver. The final design of the Hotbox provides for takeoff distance in 26.5 ft and normal cruise range of 17,000 ft. Author

N92-21374*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
FINAL DESIGN PROPOSAL: DELTA GROUP-NOOD RIDER 821(TM)
C. B. Pastega, B. P. Vahey, K. W. Hoffman, M. C. Doherty, M. J. Fay, A. L. Konesky, D. C. Lilly, and D. J. Moody May 1991 73 p Sponsored in part by Boeing Commercial Airplane Co.
(Contract NASw-4435)
(NASA-CR-190020; NAS 1.26:190020) Avail: NTIS HC/MF A04 CSCL 01C

The Nood Rider 821 (trademark) twin-engine, prop passenger aircraft is described. It is argued that the aircraft is very economical to operate and maintain, offering competitive advantages in the air travel marketplace. The aircraft was designed to operate in 'Aeroworld', a fictional world where the passengers are ping pong balls and the distances between cites are on the order of thousands of feet. Author

N92-21375*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
FINAL DESIGN PROPOSAL: BETA SYSTEMS-EL TORO. A PROPOSAL IN RESPONSE TO A COMMERCIAL AIR TRANSPORTATION STUDY
Steve Muenzberg, Shane Gillespie, Jim Coogan, Pat Monahan,

Liam Bruen, Bob Wincer, and Rob Wilkey May 1991 115 p
Sponsored in part by Boeing Commercial Airplane Co.
(Contract NASw-4435)
(NASA-CR-189999; NAS 1.26:189999) Avail: NTIS HC/MF A06 CSCL 01C

El Toro is a remotely piloted airplane designed to operate as a commercial aircraft in a fictional 'Aeroworld' where the passengers are ping-pong balls and the distances between cities are on the order of thousands of feet. The present design for El Toro will profitably meet the requirements for operation in Aeroworld with a ticket price comparable the ticket prices of current transportation. The extended range of El Toro allows for numerous flights to be flown before the battery pack needs to be changed. This drastically reduces the operating costs to the airlines, allowing them to charge less for a ticket or else to realize a higher profit margin. Author

N92-21448*# Universities Space Research Association, Houston, TX.
NASA/USRA HIGH ALTITUDE RESEARCH AIRCRAFT. GRYPHON: SOAR LIKE AN EAGLE WITH THE ROAR OF A LION Final Report
Jose Rivera, Anne Nunes, Mike McRay, Walter Wong, Audrey Ong, and Scott Coble 1991 104 p
(Contract NASw-4435)
(NASA-CR-190002; NAS 1.26:190002) Avail: NTIS HC/MF A06 CSCL 01C

At the equator, the ozone layer ranges from 65,000 to 130,000+ feet. This is beyond the capabilities of the ER-2, which is NASA's current high altitude reconnaissance aircraft. The Universities Space Research Association, in cooperation with NASA, is sponsoring an undergraduate program which is geared to designing an aircraft that can study the ozoned layer at the equator. This aircraft must be able to satisfy four mission profiles. Mission one is a polar mission which ranges from Chile to the South Pole and back to Chile, a total range of 6000 n. mi. at 100,000 feet with a 2500 lb. payload. The second mission is also a polar mission with a decreased altitude of 70,000 feet and an increased payload of 4000 lb. For the third mission, the aircraft will take-off at NASA Ames, cruise at 100,000 feet carrying a 2500 lb. payload, and land in Puerto Montt, Chile. The final mission requires the aircraft to take-off at NASA Ames, cruise at 100,000 feet with a 1000 lb. payload, make an excursion to 120,000 feet, and land at Howard AFB, Panama. All three missions require that a subsonic Mach number be maintained due to constraints imposed by the air sampling equipment. The aircraft need not be manned for all four missions. Three aircraft configurations were determined to be the most suitable for meeting the above requirements. The performance of each configuration is analyzed to investigate the feasibility of the project requirements. In the event that a requirement can not be obtained within the given constraints, recommendations for proposal modifications are given. Author

N92-21449*# California State Polytechnic Univ., Pomona. Dept. of Aerospace Engineering.
THE HAMMER: HIGH ALTITUDE MULTIPLE MISSION ENVIRONMENTAL RESEARCHER Final Report
Darren Hayashi, Cara Zylla, Ernesto Amaro, Phil Colin, Thomas Klause, Bernardo Lopez, and Danna Williamson 28 May 1991 121 p
(Contract NASw-4435)
(NASA-CR-190001; NAS 1.26:190001) Avail: NTIS HC/MF A06 CSCL 01C

At the equator, the ozone layer ranges from 65,000 to 130,000+ feet which is beyond the capabilities of the ER-2, NASA's current high altitude reconnaissance aircraft. The Universities Space Research Association, in cooperation with NASA, is sponsoring an undergraduate program which is geared to designing an aircraft that can study the ozone layer at the equator. This aircraft must be able to satisfy four mission profiles. Mission one is a polar mission which ranges from Chile to the South Pole and back to Chile, a total range of 6000 n. mi. at 100,000 feet with a 2500 lb. payload. The second mission is also a polar mission with a decreased altitude of 70,000 feet and an increased payload of 4000 lb. For the third mission, the aircraft will take-off at NASA Ames, cruise at 100,000 feet carrying a 2500 lb. payload, and land in Puerto Montt, Chile. The final mission requires the aircraft to take-off at NASA Ames, cruise at 100,000 feet with a 1000 lb. payload, make an excursion to 120,000 feet, and land at Howard AFB, Panama. All three missions require that a subsonic Mach number is maintained due to constraints imposed by the air sampling equipment. The aircraft need not be manned for all four missions. Three aircraft configurations were determined to be the most suitable for meeting the above requirements. The performance of each configuration is analyzed to investigate the feasibility of the project requirements. In the event that a requirement can not be obtained within the given constraints, recommendations for proposal modifications are given. Author

N92-21489*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
THE SNODOG: PRELIMINARY DESIGN OF A CLOSE AIR SUPPORT AIRCRAFT
Scott Ashbaugh, Kent Bartel, J. R. Cavalli, John Chan, Jason Chung, Liza Dimaranan, Mike Freese, Rick Levitt, and Dani Soban 17 May 1991 110 p
(Contract NASw-4435)
(NASA-CR-189990; NAS 1.26:189990) Avail: NTIS HC/MF A06 CSCL 01C

U.S. military forces are presently searching for the next generation Close Air Support aircraft. The following report presents the SnoDog, a low-cost ($14.8 million) aircraft capable of operating from remote battlefields and unimproved airstrips. The configuration consists of a conventional, low aspect-ratio wing, twin booms, twin canted vertical stabilizers along with a high-mounted joined horizontal tail. A supercritical airfoil for the wing enhances aerodynamic performance, while the SnoDog's instability increases maneuverability over current close air support aircraft. Survivability was incorporated into the design by the use of a titanium tub to protect the cockpit from anti-aircraft artillery, as well as, the twin booms and retracted gear disposition. The booms aid survivability by supplying separated, redundant controls, and the landing gear are slightly exposed when retracted to enable a belly landing in emergencies. Designed to fly at Mach .76, the SnoDog is powered by two low-bypass turbofan engines. Engine accessibility and interchangeable parts make the SnoDog highly maintainable. The SnoDog is adaptable to many different missions, as it is capable of carrying advanced avionics pods, carrying external fuel tanks or refueling in-air, and carrying various types of munitions. This makes the SnoDog a multirole aircraft capable of air-to-air and air-to-ground combat. This combination of features make the SnoDog unique as a close air support aircraft, capable of meeting the U.S. military's future needs. Author

N92-21540*# Auburn Univ., AL. Dept. of Aerospace Engineering.
THE LANGLEY TURBO-PROP COMMUTER DESIGN: A COMPLETE PROJECT DESCRIPTION
Greg Buttram, Keith Horton, Tim Keeter, Paul Millhouse, Kelli Newberry, and Brian OByrne 4 Jun. 1991 40 p
(Contract NASw-4435)
(NASA-CR-189987; NAS 1.26:189987) Avail: NTIS HC/MF A03 CSCL 01C

The primary objective of this project was to propose and prove the possibility of a new, advanced technology commuter aircraft design. Among the specifications were short to medium range capabilities, low seat per mile cost, fuel efficiency, and passenger comfort. Based on market evaluation, we found that the optimum size for new regional aircraft is around 50 passengers; we have designed our aircraft for this capacity. Turboprop engines provide substantial reductions in operating costs due to lower fuel consumption. We have therefore chosen an advanced turboprop engine. Composite materials, while more expensive to purchase and manufacture, result in decreased costs later through weight savings and ease of replacement. Author

N92-21565*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
MANX: CLOSE AIR SUPPORT AIRCRAFT PRELIMINARY DESIGN
Annie Amy, David Crone, Heidi Hendrickson, Randy Willis, and Vince Silva 25 Nov. 1991 65 p
(Contract NASw-4435)
(NASA-CR-189992; NAS 1.26:189992) Avail: NTIS HC/MF A04 CSCL 01C

The Manx is a twin engine, twin tailed, single seat close air support design proposal for the 1991 Team Student Design Competition. It blends advanced technologies into a lightweight, high performance design with the following features: High sensitivity (rugged, easily maintained, with night/adverse weather capability); Highly maneuverable (negative static margin, forward swept wing, canard, and advanced avionics result in enhanced aircraft agility); and Highly versatile (design flexibility allows the Manx to contribute to a truly integrated ground team capable of rapid deployment from forward sites). Author

N92-21566*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
THE GUARDIAN: PRELIMINARY DESIGN OF A CLOSE AIR SUPPORT AIRCRAFT
Jonathan Haag, David Huber, Kelly McInerney, Greg Mulligan, David Pessin, and Michael Seelos 17 May 1991 126 p
(Contract NASw-4435)
(NASA-CR-189991; NAS 1.26:189991) Avail: NTIS HC/MF A07 CSCL 01C

One design is presented of a Close Air Support (CAS) aircraft. It is a canard wing, twin engine, twin vertical tail aircraft that has the capability to cruise at 520 knots. The Guardian contains state of the art flight control systems. Specific highlights of the Guardian include: (1) low cost (the acquisition cost per airplane is $13.6 million for a production of 500 airplanes); (2) low maintenance (it was designed to be easily maintainable in unprepared fields); and (3) high versatility (it can perform a wide range of missions). Along with being a CAS aircraft, it is capable of long ferry missions, battlefield interdiction, maritime attack, and combat rescue. The Guardian is capable of a maximum ferry of 3800 nm, can takeoff in a distance of 1700 ft, land in a ground roll distance of 1644 ft. It has a maximum takeoff weight of 48,753 lbs, and is capable of carrying up to 19,500 lbs of ordinance. Author

N92-21567*# California Polytechnic State Univ., San Luis Obispo.
A-2000: CLOSE AIR SUPPORT AIRCRAFT DESIGN TEAM
Paul Carrannanto, Don Lim, Evangeline Lucas, Alan Risse, Dave Weaver, and Steve Wikse 25 Nov. 1991 82 p
(Contract NASw-4435)
(NASA-CR-190022; NAS 1.26:190022) Avail: NTIS HC/MF A05 CSCL 01C

The US Air Force is currently faced with the problem of providing adequate close air support for ground forces. Air response to troops engaged in combat must be rapid and devastating due to the highly fluid battle lines of the future. The A-2000 is the result of a study to design an aircraft to deliver massive fire power accurately. The low cost A-2000 incorporates: large weapons payload; excellent maneuverability; all weather and terrain following capacity; redundant systems; and high survivability. Author

N92-21587* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SERRATED TRAILING EDGES FOR IMPROVING LIFT AND DRAG CHARACTERISTICS OF LIFTING SURFACES Patent
Paul M. H. W. Vijgen, inventor (to NASA), Floyd G. Howard, inventor (to NASA), Dennis M. Bushnell, inventor (to NASA), and Bruce J. Holmes, inventor (to NASA) 18 Feb. 1992 14 p Filed 31 Oct. 1989 Supersedes N90-15094 (28 - 7, p 879)
(NASA-Case-LAR-13870-1-CU; US-Patent-5,088,665; US-Patent-Appl-SN-429516; US-Patent-Class-244-200; US-Patent-Class-244-198; US-Patent-Class-244-212; US-Patent-Class-244-215; Int-Patent-Class-B64C-21/10) Avail: US Patent and Trademark Office CSCL 01C

An improvement in the lift and drag characteristics of a lifting surface is achieved by attaching a serrated panel to the trailing edge of the lifting surface. The serrations may have a saw-tooth configuration, with a 60 degree included angle between adjacent serrations. The serrations may vary in shape and size over the span-wise length of the lifting surface, and may be positioned at fixed or adjustable deflections relative to the chord of the lifting surface.
Official Gazette of the U.S. Patent and Trademark Office

N92-21856 West Virginia Univ., Morgantown.
HELICOPTER ROTOR BLADE DYNAMICS WITH BILINEAR FORMULATION Ph.D. Thesis
Grzegorz Kawiecki 1991 224 p
Avail: Univ. Microfilms Order No. DA9203852

A time finite element method based on Hamilton's Law of Varying Action (HLVA) is applied to the analysis of the dynamics of nonlinear systems. The helicopter blade is chosen as an example of a dynamical system. The temporal dependence of the equations of motion is discretized using the bilinear formulation of the HLVA. The convergence of this method for initial value and boundary value linear, temporal problems has been proven by others. An attempt is made to apply the bilinear formulation of HLVA to solve a system of nonlinear differential equations modeling a nonconservative dynamical system. Two approaches for the numerical implementation of the bilinear formulation are developed. One obtains the response of a general dynamical system using marching in time. The other is based on the assumption that the solution is identical at the beginning and at the end of one period. The feasibility of the bilinear formulation for solving nonlinear problems is shown on an example of a two degree of freedom, strongly nonlinear dynamical system. It is shown that although the bilinear formulation offers good stability and convergence characteristics it cannot match the speed of standard integration algorithms large nonlinear systems. Dissert. Abstr.

N92-21951# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Flight Mechanics Panel.
AIRCRAFT SHIP OPERATIONS
Nov. 1991 340 p In ENGLISH and FRENCH Symposium held in Seville, Spain, 20-23 May 1991
(AGARD-CP-509; ISBN-92-835-0641-3) Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The Symposium considered problems of mutual interest connected with fixed and rotary wing aircraft operations from ships, and the application of new technology to enhance such operations. The topics covered included the ship environment in terms of wind, temperature, precipitation, turbulence, and deck motion; guidance, controls, and displays, primarily in the approach and landing phase; flight test and simulation techniques; launch, recovery, and handling systems developments; operational/pilot views; and future developments. For individual titles, see N92-21952 through N92-21974.

N92-21952# Naval Sea Systems Command, Washington, DC. Hull Form and Hydrodynamic Performance Div.
DECK MOTION CRITERIA FOR CARRIER AIRCRAFT OPERATIONS
J. H. Pattison and R. R. Bushway (Naval Air Systems Command, Washington, DC.) *In* AGARD, Aircraft Ship Operations Nov. 1991 18 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Updated ship motion criteria for conventional fixed wing aircraft launch, recovery, and handling operations are presented. The criteria were required to evaluate the effectiveness of proposed hull modifications for USS MIDWAY (CV41). A balanced approach was used to develop the criteria; including a review of existing criteria, an air department workshop, motion measurements during

aircraft operations aboard USS MIDWAY and USS CONSTELLATION, flight simulations of aircraft recovery, and a study of the sensitivity of operability calculations to changes in the criteria. Deck attitude (list and trim) and wind limitations are discussed. Sample results are presented to show how the criteria are used to evaluate the effects of hull improvements in a typical operating area of the ocean. It is shown how the criteria may be used in onboard motion displays to guide the ship operator to best speeds and headings to avoid deck motion effects on operations. Author

N92-21953# Naval Postgraduate School, Monterey, CA. Dept. of Aeronautics and Astronautics.
THE AERODYNAMICS OF SHIP SUPERSTRUCTURES c34
J. V. Healey *In* AGARD, Aircraft Ship Operations Nov. 1991 14 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

After 70 years of naval aviation, a belated understanding of the aerodynamics of ships is slowly emerging. The lack of understanding, and undoubtedly other reasons, has led to superstructure configurations that are unsuited to adjacent helicopter flight. This has resulted in severely limited safe operating envelopes, danger to pilots and ship personnel and blade strikes that occasionally result in the complete loss of a helicopter. The air flows around ships abound with recirculating zones, bounded by shear layers that emanate from the sharp edges of the superstructures. These zones vary enormously in size in an intermittent manner, giving rise to flows with extreme velocity gradients and turbulence intensity levels that are too high to be measured with hot wire anemometers. This complicates the situation because, at the present time, a data base for simulation can be established only via measurement. The essential ingredients for the aerodynamic design of new ships are proposed and some suggestions for the improvement of the aerodynamics of existing ships are made. Correcting an aerodynamically poor ship is no substitute for the incorporation of aerodynamics into the ship design process. Author

N92-21954# Naval Air Test Center, Patuxent River, MD. Rotary Wing Aircraft Test Directorate.
SHIP AIRWAKE MEASUREMENT AND MODELING OPTIONS FOR ROTORCRAFT APPLICATIONS c34
Dean Carico, Bill Reddy, and Charles DiMarzio (Northeastern Univ., Boston, MA.) *In* AGARD, Aircraft Ship Operations Nov. 1991 24 p (For primary document see N92-21951 12-05)
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Ship airwake is important in defining rotorcraft ship operational limitations and in predicting those limitations using analysis and simulation. Accurate real time ship airwake models are required to support pilot shipboard landing training in aviation training devices. Increased emphasis must be placed on obtaining quantitative full scale airwake data and in quantitatively evaluating ship airwake simulation models. Quantitative ship airwake data measurement equipment ranges from hand held mechanical sensors, to propeller anemometers mounted on a mast, to possible laser velocimeter and other options in the near future. Wind tunnel and computational fluid dynamics options are also possible candidates for ship airwake data generation. It is important to compare the different techniques for obtaining ship airwake data and evaluate the utility and strengths and weaknesses of each technique. Many activities in the U.S. and in other countries are involved in rotorcraft shipboard landing flight test, analysis, and simulation. Author

N92-21955# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
MEASUREMENT OF THE FLOW DISTRIBUTION OVER THE FLIGHT DECK OF AN AIRCRAFT CARRIER c34
M. Mulero and F. Gomez Portabella *In* AGARD, Aircraft Ship Operations Nov. 1991 12 p (For primary document see N92-21951 12-05)
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A study was conducted on the general configuration of the air flow over the flight deck of a Spanish aircraft carrier. The level was determined of fluctuations of the wind vector in certain points of the deck where operations of VSTOL planes and helicopters take place. It was decided to study the possibility of making wind tunnel testing over a reduced scale model of the ship and later take some limited data over the actual ship. Preliminary tests to assess the validity of the simulation of the main flow features in the wind tunnel were performed over a simple square cube and they showed a systematic constancy in the shape of the cavity and the wake as a function of the Reynolds numbers studied. Tests were then performed on a reduced scale model of the ship and data were gathered by means of hot film probes and by photographing wool tufts attached to the surface of the model. Results show separation past the leading edge of the ramp, which produces vortices that trail along and over the deck to distances that depend on the direction of the approach wind. Limited data of local velocities and direction in the horizontal plane were obtained over the real ship, which show the highly disturbed flow. Author

N92-21956*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
A NEW METHOD FOR SIMULATING ATMOSPHERIC TURBULENCE FOR ROTORCRAFT APPLICATIONS
J. Riaz, J. V. R. Prasad, D. P. Schrage, and G. H. Gaonkar (Florida Atlantic Univ., Boca Raton.) *In* AGARD, Aircraft Ship Operations Nov. 1991 6 p Previously announced in IAA as A92-14368 (For primary document see N92-21951 12-05)
(Contract NCA2-512)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive CSCL 01C

Simulation of atmospheric turbulence as seen by a rotating blade element involves treatment of cyclostationary processes. Conventional filtering techniques do not lend themselves well to the generation of such turbulence sample functions as are required in rotorcraft flight dynamics simulation codes. A method to generate sample functions containing second order statistics of mean and covariance is presented. Compared to ensemble averaging involving excessive computer time, the novelty is to exploit cycloergodicity and thereby, replace ensemble averaging by averaging over a single path sample function of long duration. The method is validated by comparing its covariance results with the analytical and ensemble averaged results for a widely used 1-D turbulence approximation. Author

N92-21957# Naval Air Test Center, Patuxent River, MD.
ENHANCED DISPLAYS, FLIGHT CONTROLS, AND GUIDANCE SYSTEMS FOR APPROACH AND LANDING c04
R. W. Huff and G. K. Kessler *In* AGARD, Aircraft Ship Operations Nov. 1991 22 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The Navy has had an ongoing objective to provide a safe and reliable approach and landing capability with minimum interference from severe weather and sea state, and no limitation due to low ceiling and visibility. An overview is presented of the present and future Navy displays, flight controls, and guidance systems for approach and landing. The results of simulation studies and flight tests concerning enhancement to aircraft displays and flight controls are discussed. The various tradeoffs and issues that must be considered are also discussed. Tradeoffs in landing system accuracy requirements versus integration of aircraft and shipboard data are explored. Author

N92-21958# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INTEGRATION OF FLIGHT AND CARRIER LANDING AID SYSTEMS FOR SHIPBOARD OPERATIONS **c04**
B. Dang Vu, T. LeMoing, and P. Costes *In* AGARD, Aircraft Ship Operations Nov. 1991 15 p (For primary document see N92-21951 12-05)
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The operational availability of a carrier depends to a large extent on the capacity of its equipment and its aviation to operate in a wide domain of meteorological conditions and sea states. Some equipments are under development for the future French nuclear carrier in order to extend its operational limits for aircraft launch and recovery: a deck motion tranquillization system, a deck motion prediction system, and an all-weather aircraft localization system. The impact on deck landing procedures for future carrier-based fighter aircraft is presented. An improved terminal guidance landing strategy making use of the prediction of the carrier motion is proposed. The actual glide path with fixed slope is replaced by a flight path along which the aircraft airspeed and flight path angle are updated in accordance with the predicted deck motion at touchdown, such that all the landing constraints are respected: minimum hook-to-ramp clearance, maximum touchdown sink rate.... The integration of the landing aid systems with the aircraft flight control system will allow the implementation of an automatic landing mode or advanced manual task-tailored control modes. Preliminary simulation results give a general idea on the improvement of deck landing performances with respect to the accuracy of the prediction of the carrier motion. Author

N92-21959# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
APPROACH AND LANDING ASSISTED BY ONBOARD IMAGE PROCESSING [APPROCHE ET APPONTAGE ASSISTES PAR TRAITEMENT D'IMAGE EMBARQUE SUR AERONEF] **c04**
Y. LeGuilloux *In* AGARD, Aircraft Ship Operations Nov. 1991 10 p In FRENCH (For primary document see N92-21951 12-05)
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A study is made of automation of visual control by an aircraft pilot during landing. The system that is envisaged, comprising one camera (infrared) and the associated electronics for real time image processing, will provide continuous 3-D representation of the aircraft's position in relation to the ship. To do this, the principal characteristics of the aircraft carrier are first localized in the image, then paired with their equivalents in the 3-D model of an a priori known aircraft carrier. By inverse perspective transformation, the pilot is able to determine the position of the ship relative to the aircraft, and from this information he can derive the position and movement of the aircraft relative to the ship. Thus, the system is able to measure the distance from an ideal landing scenario and from there the appropriate compensating actions can be determined. Furthermore, the absolute movement of the aircraft, given by the inertial system, may be combined with the relative movement to give the absolute movement of the ship. Author

N92-21960# Royal Aerospace Establishment, Bedford (England).
APPROACH AND LANDING GUIDANCE **c04**
A. J. Smith and E. J. Guiver *In* AGARD, Aircraft Ship Operations Nov. 1991 15 p (For primary document see N92-21951 12-05)
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The final approach and landing of any aircraft operating from a ship is always a difficult task, even in benign conditions. Ship motion, adverse winds, and atmospheric attenuation compound the problems. High levels of integrity and reliability are an essential feature of any guidance aid in the ship environment since diversion facilities are often not available. Issues related to cost, maintainability, levels of training, and covertness further constrain the choice of guidance aid. The handling characteristics of the user aircraft and operational procedures also influence the choice of aid. To achieve the objective of regular and safe operations in all weather conditions, some form of guidance must be provided. The options range from painted markings and lighting systems that are used by the pilot to augment naturally occurring visual cues to precision radio or radar systems that are integrated into cockpit displays and flight control systems. In military operations there is a perceived need for passive or covert forms of guidance. The development of electro-optical sensors in recent years has increased the number of options and the availability of the Global Positioning System (GPS) will provide even more potential solutions to the design problems of providing precision guidance. The topics of approach and landing guidance has encouraged a large amount of research and development over the years, with many special-to-type solutions being devised. Except for the helicopter landing case, where relatively little research and development effort has been expended, the system designer is confronted with a large number of potential solutions. The above topics are addressed and conclusions are presented. Author

N92-21961# Kaman Aerospace Corp., Bloomfield, CT.
ANALYTICAL MODELING OF SH-2F HELICOPTER SHIPBOARD OPERATION
Fu-Shang Wei, Erich Baitis, and William Myers (David Taylor Research Center, Bethesda, MD.) *In* AGARD, Aircraft Ship Operations Nov. 1991 11 p (For primary document see N92-21951 12-05)
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An analysis of the shipboard characteristics of the SH-2F helicopter in response to prescribed deck motion, deck friction, and steady wind conditions was developed. The objective of deriving the SH-2F shipboard dynamic model is to define the safe conditions for launching and recovering the helicopter from the flight deck of Navy frigates and destroyers. Operational conditions of interest include helicopter and ship deck dynamic interactions which would potentially cause dangerous interference between the helicopter and the ship such as sliding or tipping of the helicopter. The wind condition, ship deck motion, helicopter rotor thrust, and friction coefficients between helicopter tires and flight deck surfaces are found to be important parameters which affect the helicopter shipboard operations. Four sets of aerodynamic characteristics are modeled in the analysis: one with the rotor operating at very low thrust; one for the rotor stopped and inoperative; one for rotor folded; and one for the fuselage. The ship motion data, including three linear translation and two angular rotation degrees of freedom (roll and pitch) are described in the time domain. The equations of motion of the shipboard dynamic model are derived using the energy method. These equations are solved in the quasi-steady fashion within one-third of a second refresher rate to the prescribed deck motion time histories and steady wind conditions. Author

N92-21962# Canadair Ltd., Montreal (Quebec). Surveillance Systems Div.
HELICOPTER/SHIP ANALYTIC DYNAMIC INTERFACE
Bernard Ferrier, Henry Polvi (National Defence Headquarters, Ottawa, Ontario), and Francois A. Thibodeau *In* AGARD, Aircraft Ship Operations Nov. 1991 20 p (For primary document see N92-21951 12-05)
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An analytic approach to helicopter/ship dynamic interface testing is introduced. The development of dynamic interface from ship motion simulation is presented. A demonstration of a deck handling clearance study is performed for an EH101 helicopter and CPF ship model. Preliminary results of the Landing Period Designator Development Project are provided. Author

N92-21963# Naval Air Test Center, Patuxent River, MD. Strike Aircraft Test Directorate.
EVALUATING FIXED WING AIRCRAFT IN THE AIRCRAFT CARRIER ENVIRONMENT

C. P. Senn *In* AGARD, Aircraft Ship Operations Nov. 1991 9 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Operating fixed wing aircraft from today's modern aircraft carrier is a demanding task. Evaluation of aircraft/ship compatibility, both during the concept development phase and full scale development (FSD) ground and flight tests presents the evaluation team with unique challenges. The capabilities and characteristics of high performance carrier based tactical aircraft must be quantified for the catapult launch and subsequent flyaway, and the carrier approach and arrested landing tasks. Catapult launching involves determining the minimum safe launch airspeeds while maintaining acceptable flight characteristics in this low altitude, high angle of attack (AOA) regime. Approach and landing requires the slowest possible approach airspeeds while retaining the performance and handling qualities needed for precision glide slope control. Defining the lowest catapult launch and landing airspeeds reduces wind over deck (WOD) requirements, resulting in reduced ship's operating speed and increased operational flexibility. The tight operating confines of the flight and hanger decks, in conjunction with the large number of other aircraft, support equipment, and personnel dictate unique design requirements which must be considered in the earliest design stages of a new airplane. The shore based and shipboard ground and flight tests which are conducted to assess the flying qualities, performance, and structural suitability of an airplane in the aircraft carrier environment are addressed. Author

N92-21964# Agusta Sistemi S.p.A., Varese (Italy). Flight Test Dept.
EH 101 SHIP INTERFACE TRIALS: FLIGHT TEST PROGRAMME AND PRELIMINARY RESULTS
R. Longobardi, G. Vismara, and B. Paggi *In* AGARD, Aircraft Ship Operations Nov. 1991 7 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The development program of the EH 101 includes, for its naval variant, the investigation of the ship-helicopter interface characteristics to grant a preliminary release for helicopter operations on board Italian and British Navy units. The testing will be done according to the following scheme: (1) EH 101 handling qualities assessment while operating near a ship, during the final approach phase; (2) deck landings and take-offs for a preliminary identification of deck motion limits and wind envelope; (3) assessment of the deck landing technique with the use of landing aids; (4) assessment of the aircraft landing on the deck, rotors folding, refueling, armament loading, taxiing, tie downs, etc.; (5) assessment of helicopter operations in a heavy electromagnetic environment; and (6) assessment of the maintainability characteristics of the EH 101 in limited spaces (engine and gear boxes change). Additionally, the results of the preliminary sea trials carried out with the EH 101 prototypes will be presented. Author

N92-21965# National Aerospace Lab., Amsterdam (Netherlands).
DETERMINATION OF LIMITATIONS FOR HELICOPTER SHIP-BORNE OPERATIONS
R. Fang *In* AGARD, Aircraft Ship Operations Nov. 1991 9 p (For primary document see N92-21951 12-05)
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A brief outline of helicopter-ship qualification programs, as performed by the National Aerospace Laboratory NLR (the Netherlands), is given. The outline describes how detailed information about the helicopter's capabilities, the ship's motion characteristics, and the wind-climate above the ship's flight deck is used to set up and to execute a safe and efficient helicopter flight test program. The program leads to a safe and maximum operational availability of the helicopter on board the ship in terms of take-off and landing capabilities as functions of relative wind and sea-state. Author

N92-21966# Aeroplane and Armament Experimental Establishment, Boscombe Down (England). Rotary Wing Performance Section.
UNITED KINGDOM APPROACH TO DERIVING MILITARY SHIP HELICOPTER OPERATING LIMITS
B. A. Finlay *In* AGARD, Aircraft Ship Operations Nov. 1991 14 p Sponsored in part by Ministry of Defence (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

In the United Kingdom the Aeroplane and Armament Experimental Establishment (A&AEE) is responsible for conducting trials to determine the limitations appropriate to military Ship Helicopter Operations. The philosophy behind these trials is presented. Additionally, the many considerations which play a part in successful trials are discussed. The tests which are carried out before trials at sea are described together with details of how trials are conducted with a helicopter and a ship to determine the widest possible operating envelopes. It is concluded that the methods used by the A&AEE establish envelopes for any particular combination of aircraft and ship that are both operationally valuable and safe. Author

N92-21967# Aeronautical Research Labs., Melbourne (Australia). Flight Mechanics and Propulsion Div.
A REVIEW OF AUSTRALIAN ACTIVITY ON MODELLING THE HELICOPTER/SHIP DYNAMIC INTERFACE
A. M. Arney, J. Blackwell, L. P. Erm, and N. E. Gilbert *In* AGARD, Aircraft Ship Operations Nov. 1991 13 p Sponsored by Royal Australian Navy (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The Aeronautical Research Laboratory (ARL) was tasked by the Royal Australian Navy (RAN) to develop a computer model of the S-70B-2 Seahawk/FFG-7 dynamic interface and to use this to investigate operational problems and limitations. An overview of the status of the task is presented, with particular emphasis on undercarriage dynamics and studies of the airwake in the region of the flight deck. For the undercarriage model, modification resulting from static trials, as well as plans for dynamic trials, are given. For the airwake studies, only preliminary results are available. These relate to full-scale airwake and ship motion trials aboard the FFG-7 class frigate HMAS Darwin, and 'mean flow' airwake studies in the low-speed wind tunnel at ARL using a 1/64th size model of an FFG-7 Author

N92-21968# Naval Air Test Center, Patuxent River, MD. Strike Aircraft Test Directorate.
UNITED STATES NAVY SKI JUMP EXPERIENCE AND FUTURE APPLICATIONS
T. C. Lea, III, C. P. Senn, and J. W. Clark, Jr. (Naval Air Development Center, Warminster, PA.) *In* AGARD, Aircraft Ship Operations Nov. 1991 15 p (For primary document see N92-21951 12-05)
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The United States Navy has evaluated the performance benefits of using a ski jump during takeoff. The significant gains available with the use of Vertical and Short Takeoff and Landing (V/STOL) aircraft operating from a ski jump were documented many times in the past; however, the U.S. Navy has expanded the concept to include Conventional Takeoff and Landing (CTOL) aircraft. The results from a recent shipboard test are presented. The test was an evaluation of the AV-8B aboard the Spanish ski jump equipped ship PRINCIPE DE ASTURIAS, and a shore based flight test evaluation of CTOL aircraft operation from a ski jump ramp. The analytical tools developed during the CTOL phase of testing are used to project the benefits which could be realized by combining the steam powered catapult and a 'mini' ski jump ramp compatible with today's aircraft carriers. Author

N92-21969# RDM Technology, Rotterdam (Netherlands).
HELICOPTER HANDLING: EXPERIENCE AND NEW DEVELOPMENTS
W. R. M. Reimering and T. Craig (MacTaggart, Scott and Co. Ltd., Loanhead, Scotland) *In* AGARD, Aircraft Ship Operations Nov. 1991 18 p (For primary document see N92-21951 12-05)
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In the last 25 years, helicopter handling became a necessity in order to meet the mission requirements for operating helicopters from small ships. A survey of experiences and new developments in the field of helicopter handling is presented. The interface solutions, that are provided, take into consideration restrictions imposed by the airframe and the ship's construction. One set of solutions concentrates heavily on helicopter traversing systems. The other solutions discuss the landing grid and the design and construction of the decklock (sometimes referred to as the harpoon or talon). Author

N92-21970# Dassault-Breguet Aviation, Saint Cloud (France). Direction General Technique.
DYNAMIC PERFORMANCE OF AN AIRCRAFT ON ITS LANDING GEAR: TEST AND EVALUATION ON A DIHEDRAL [COMPORTEMENT DYNAMIQUE D'UN AVION SUR SES ATTERRISSEURS: EXPERIMENTATION ET VALIDATION PAR FRANCHISSEMENT D'UN DIEDRE]
D. Fleygnac and E. Bourdais *In* AGARD, Aircraft Ship Operations Nov. 1991 13 p In FRENCH (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The essential role of the dynamic performance of landing gear in this study of instances of contact with the ground and, more particularly, the analysis of catapulting marine aircraft has justified the desire to validate the models used in the design phase of existing aircraft. Described here is the preparation, installation, and use of a dihedral to launch a MIRAGE 2000. These trials permitted a detailed identification of the performance characteristics of landing gear in a particular dynamic phase that is fairly representative of the conditions encountered when catapulting, as well as the aerodynamic effectiveness of control surfaces with ground effect. Author

N92-21971# British Aerospace Public Ltd. Co., Lancashire (England). Advanced Studies Dept.
SOME IMPLICATIONS FOR ADVANCED STOVL OPERATION FROM INVINCIBLE CLASS SHIPS
K. Ainscow and P. G. Knott *In* AGARD, Aircraft Ship Operations Nov. 1991 10 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Replacing the Sea Harrier with a high performance Advanced Short Takeoff and Vertical Landing (ASTOVL) design for use on Invincible class ships was studied. Four different ASTOVL propulsion concepts are discussed. The integration of these larger, heavier aircraft with the small ship carrying EH101 helicopters is discussed. It is shown that the constraints of the ship and the size and performance of the aircraft require some changes in operational procedures when compared with Sea Harrier practice. The higher takeoff thrust to weight ratio and more hostile exhaust plumes suggest the use of the aft deck for recovery, a shorter deck run with the sky ramp for launching, and a blast deflector between the two areas. A study of the deck environment generated by the ASTOVL aircraft indicates that a delicate balance among size, mass, performance and exhaust environment will need to be struck in future Sea Harrier replacement studies for small ship operation. Author

N92-21972# Naval Weapons Center, China Lake, CA.
FIXED WING NIGHT CARRIER AEROMEDICAL CONSIDERATIONS **c54**
J. C. Antonio *In* AGARD, Aircraft Ship Operations Nov. 1991 3 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Discussed here are the emerging use of night vision devices (NVDs) in the United States Navy/United States Marine Corps fixed wing aircraft, a description of the NVD environment, and the identification of aeromedical concerns associated with night carrier operations. Enhancements to the F-18 night strike mission provided by NVDs include increased situational awareness, enhanced night navigation, threat avoidance, multi/mixed aircraft tactics, nighttime use of daytime tactics, and the significant expansion of night air-to-air tactics, including escort missions. Author

N92-21973# Stato Maggiore Marina, Rome (Italy).
LIMITATIONS ON HELICOPTER OPERATIONS IN THE AERONAVAL ENVIRONMENT [LIMITATIONS DES OPERATIONS DES HELICOPTERES DANS LE MILIEU AERONAVAL]
D. Falcinelli *In* AGARD, Aircraft Ship Operations Nov. 1991 6 p In FRENCH (For primary document see N92-21951 12-05)
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The particular problems faced by pilots during flight activities onboard military ships are discussed. Problems include limited space, motion of the flight deck, wind, and turbulence. Various situations were studied using helicopters, but the results can be generalized to other types of aircraft. Problems of approach and landing are of special interest. Limitations of the environment, systems that help flight operations, markings and visual cues, landing and relocation systems, and approach systems are briefly discussed. Author

N92-21974# Atlantic Research Corp., Landover, MD.
REVOLUTION AT SEA: AIRCRAFT OPTIONS FOR THE YEAR 2030
James C. Biggers and Peter A. Silvia (David Taylor Research Center, Bethesda, MD.) *In* AGARD, Aircraft Ship Operations Nov. 1991 12 p (For primary document see N92-21951 12-05)
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Some innovative options for future aircraft and a revolutionary approach to the ships from which they operate are presented. Some options have been explored through the preliminary design stage, some are only at the conceptual design stage, and others are mere speculation. The limitations of the present fleet are noted, along with some possible solutions. All options assume the integration of ships and aircraft in more depth than previously. The objective here is to create in the reader a vision of the future surface and air fleet that is significantly different from today's Navy, and to get the reader involved in bringing this vision to reality. Author

N92-22000# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Munich (Germany, F.R.). Materials and Structures Research Dept.
MATERIALS AND STRUCTURES RESEARCH DEPARTMENT: SCIENTIFIC REPORT (1990)
Dorothea Koch-Peters, ed. and Marianne Salein, ed. 1991 151 p In ENGLISH and GERMAN Original contains color illustrations
(ISSN-0174-3910; ETN-92-90727) Avail: NTIS HC/MF A08

The research and development tasks are directed towards two basic requirements of aircraft construction, ultraweight structures and high efficiency propulsion systems, towards the main challenges of hypersonic and reentry flight, high temperatures and temperature gradients, and towards related problems of energy technology. The scope of the research department's work stretches from materials research to design, construction and processing methods, to structural-dynamic and aeroelastic performance, and to testing and qualification of aerospace devices, supplemented

by investigations of innovative materials and substances to be produced under zero gravity conditions. In detail the following activities are being pursued: production technology and materials research on production of rapidly solidified metals, fiber-reinforced Al, Mg, and Ti alloys, monolothic and fiber-reinforced high performance ceramics, fiber-reinforced plastics, layers providing protection against heat and corrosion, monocrystalline materials; material and function-adapted design principles, methods of producing and shaping components, lay-up and adhesion methods for laminates, assembly procedures, powder metallurgy, hot isostatic pressing, reaction sintering, slip-casting, infiltration techniques, automated production processes; calculation and investigation of the static, dynamic and aeroelastic performance of components and structures (rotor blades, airframe, spacecraft, buildings); the damage mechanics of fiber compounds, thermomechanics, hybrid constructions, modal coupling, and entire systems. ESA

N92-21510# Wichita State Univ., KS. Dept. of Mechanical Engineering.
A STUDY IN DYNAMIC CONTROL OF A SUPER MANEUVER WITH NEURAL NETWORKS Abstract Only
James E. Steck and Kamran Rokhsaz *In its* Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

N92-21512# Kansas Univ., Lawrence. Flight Research Lab.
THE EVALUATION OF FUNCTIONAL FIGHTER AGILITY METRICS USING OPTIMAL TRAJECTORY ANALYSIS TECHNIQUES Abstract Only
Wesley Ryan *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N92-21740# Rolls-Royce Ltd., Derby (England). Combustion Dept.
EMISSIONS FROM AIRCRAFT: STANDARDS AND POTENTIAL FOR IMPROVEMENT
D. M. Snape and M. T. Metcalfe 1 Aug. 1990 11 p Presented at the International Symposium on Freight Transport and Environment, Schereningen, Fed. Republic of Germany, 3-5 Jul. 1990
(PNR-90768; ETN-92-90760) Copyright Avail: NTIS HC/MF A03

Types of exhaust emissions produced by aircraft gas turbine engines are considered and an attempt to put these into context in both global and local airport terms with particular emphasis on freight transport is made. The basic operation of the gas turbine combustor and the need to maintain a high standard of airworthiness is discussed and the various techniques which are used to bring about emissions reductions are described. This leads into consideration of the likely trends in emission from aircraft sources as air traffic growth occurs and discussion of the need for future technological development to bring out emissions reductions. The various levels and types of technology which are associated with differing emission reductions are considered. ESA

N92-21848# Rolls-Royce Ltd., Derby (England).
COMPRESSING THE COMPRESSOR
R. J. Hill, D. J. Nicholas, and H. Tubbs 1 Nov. 1990 22 p Presented at the Dr. D. M. Smith Memorial Lecture IMechE, 10 Apr. 1990
(PNR-90824; ETN-92-90786) Copyright Avail: NTIS HC/MF A03

The development of the axial flow compressor from its conception to how it is today is outlined giving special attention to aerodynamic developments, materials used and mechanical design. The use of computers to model the aerodynamics and mechanical behavior is discussed and future trends are considered. ESA

N92-21850# Rolls-Royce Ltd., Derby (England).
THE EVOLUTION OF THE BYPASS ENGINE
G. M. Lewis 15 Nov. 1990 11 p
(PNR-90832; ETN-92-90788) Copyright Avail: NTIS HC/MF A03

The evolution of the bypass engine starting from Whittle's ducted fan patented in 1936 is described and illustrated. Throughout the evolution of the bypass engine, the basic principles and most of the relevant design configurations have been those which were established by the pioneers of jet propulsion. Progress in the civil field was contingent upon the advances in aerodynamic design to produce high efficiency single stage fans, high duty and hence short HP compressors, high temperature turbines and low drag nacelles and installations. These advances progressively reduced the mechanical design problems of concentric rotors, shafts and bearings, and enabled basically simple engines to be designed with acceptable mass. The development of fighter engines, although not directed specifically towards increased bypass ratio, contributed to the resources to evolve the advanced technologies required. Throughout the history of aviation the contribution of fighter engine development of the advance of civil engines has been evident and this will continue in the generation of advanced core technology. In the future the continuing divergence of design configuration between the civil and military engine will necessitate substantial research and development funding for the particular features of the new generation of civil engines. The future of world fuel prices and availability, and the economics of air transport systems will determine the level of investment and the pace of future progress towards the engine concepts that were identified about 40 years ago. ESA

N92-21519*# General Applied Science Labs., Inc., Ronkonkoma, NY.
PIONEERING SCRAMJET DEVELOPMENTS BY ANTONIO FERRI
John I. Erdos and Louis M. Nucci *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 10 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21520*# Wright Research Development Center, Wright-Patterson AFB, OH.
ADVANCED RAMJET CONCEPTS PROGRAM
J. L. Leingang *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21521*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE NASA HYPERSONIC RESEARCH ENGINE PROGRAM
Kennedy F. Rubert and Henry J. Lopez (Allied-Signal Aerospace Co., Torrance, CA.) *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21522*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HYPERSONIC AIRBREATHING PROPULSION/AIRFRAME INTEGRATION
John P. Weidner *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Turorial Session 1992 6 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AIRBREATHING COMBINED CYCLE ENGINE SYSTEMS
John Rohde *In its* Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21527*# Marquardt Corp., Van Nuys, CA.
SUPERCHARGED EJECTOR RAMJET
Jerry Rosevear *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Turorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21529*# Allied-Signal Aerospace Co., Torrance, CA.
H2-FUELED HIGH-BYPASS TURBOFAN
J. C. Riple *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 11 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21531*# Marquardt Corp., Van Nuys, CA.
H2 FUELED FLIGHTWEIGHT RAMJET CONSTRUCTION AND TEST
Albert Malek *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 11 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21532*# Wright Research Development Center, Wright-Patterson AFB, OH.
SCRAMJET ANALYSIS, TESTING
J. L. Leingang and F. D. Stull *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21533*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
SYSTEM CONTROLS CHALLENGES OF HYPERSONIC COMBINED-CYCLE ENGINE POWERED VEHICLES
Russell H. Morrison and George D. Ianculescu *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21534*# National Aero-Space Plane Joint Program Office, Wright-Patterson AFB, OH.
NASP X-30 PROPULSION TECHNOLOGY STATUS
William E. Powell *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

N92-21535*# National Aeronautics and Space Administration, Washington, DC.
NASA'S HYPERSONIC PROPULSION PROGRAM: HISTORY AND DIRECTION
Steve Wander *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 15 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N92-21253*# Boeing Commercial Airplane Co., Seattle, WA. New Airplane Div.
HIGH-SPEED CIVIL TRANSPORT FLIGHT- AND PROPULSION-CONTROL TECHNOLOGICAL ISSUES Final Report
J. K. Ray, C. M. Carlin, and A. A. Lambregts Mar. 1992 161 p Prepared for PRC Kentron, Inc., Edwards, CA and NASA- Hugh L. Dryden Flight Research Facility, Edwards, CA
(Contracts NAS2-12722; ATD-91-BCA-7201)
(NASA-CR-186015; H-1794; NAS 1.26:186015) Avail: NTIS HC/MF A08 CSCL 01C

Technology advances required in the flight and propulsion control system disciplines to develop a high speed civil transport (HSCT) are identified. The mission and requirements of the transport and major flight and propulsion control technology issues are discussed. Each issue is ranked and, for each issue, a plan for technology readiness is given. Certain features are unique and dominate control system design. These features include the high temperature environment, large flexible aircraft, control-configured empennage, minimizing control margins, and high availability and excellent maintainability. The failure to resolve most high-priority issues can prevent the transport from achieving its goals. The flow-time for hardware may require stimulus, since market forces may be insufficient to ensure timely production. Flight and propulsion control technology will contribute to takeoff gross weight reduction. Similar technology advances are necessary also to ensure flight safety for the transport. The certification basis of the HSCT must be negotiated between airplane manufacturers and government regulators. Efficient, quality design of the transport will require an integrated set of design tools that support the entire engineering design team. Author

N92-21357*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
THRUST VECTORING FOR LATERAL-DIRECTIONAL STABILITY
Lee R. Peron and Thomas Carpenter (California Polytechnic State Univ., San Luis Obispo.) Mar. 1992 74 p
(Contract NCC2-586)
(NASA-CR-186016; H-1645; NAS 1.26:186016) Avail: NTIS HC/MF A04 CSCL 01C

The advantages and disadvantages of using thrust vectoring for lateral-directional control and the effects of reducing the tail size of a single-engine aircraft were investigated. The aerodynamic characteristics of the F-16 aircraft were generated by using the

Aerodynamic Preliminary Analysis System II panel code. The resulting lateral-directional linear perturbation analysis of a modified F-16 aircraft with various tail sizes and yaw vectoring was performed at several speeds and altitudes to determine the stability and control trends for the aircraft compared to these trends for a baseline aircraft. A study of the paddle-type turning vane thrust vectoring control system as used on the National Aeronautics and Space Administration F/A-18 High Alpha Research Vehicle is also presented. Author

N92-21360# Naval Postgraduate School, Monterey, CA.
BASELINE VIBRATION MEASUREMENTS OF REMOTELY PILOTED HELICOPTERS FOR HIGHER HARMONIC CONTROL RESEARCH M.S. Thesis
Kevin M. Ransford Dec. 1991 70 p
(AD-A244669) Avail: NTIS HC/MF A04 CSCL 01/3

The Dept. of Aeronautics and Astronautics at the Naval Postgraduate School (NPS) is conducting a research program in methods of high harmonic control (HHC) for reduction of helicopter vibrations. The program at NPS uses remotely piloted helicopters (RPH) to study HHC effects on vibration and blade load reduction. The scope of this thesis was to measure the baseline vibration profile of the RPH test vehicles prior to the installation of a HHC system. This goal was met by the development of a data instrumentation and recording system and by conducting a ground and flight test program for the RPH test vehicles. From the results of these tests it was concluded that: (1) the data instrumentation and recording system was of sufficient sensitivity to detect vibrations experienced within the RPH airframe; and (2) the RPH exhibited a vibration profile similar to that of a full scale helicopter. It is recommended that a HHC system be designed, fabricated, and installed on the RPH so that the effects of HHC on helicopter performance may be evaluated. GRA

N92-21410*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A METHODOLOGY FOR COMPUTING UNCERTAINTY BOUNDS OF MULTIVARIABLE SYSTEMS BASED ON SECTOR STABILITY THEORY CONCEPTS
Martin R. Waszak Apr. 1992 42 p
(NASA-TP-3166; L-16846; NAS 1.60:3166) Avail: NTIS HC/MF A03 CSCL 01C

The application of a sector-based stability theory approach to the formulation of useful uncertainty descriptions for linear, time-invariant, multivariable systems is explored. A review of basic sector properties and sector-based approach are presented first. The sector-based approach is then applied to several general forms of parameter uncertainty to investigate its advantages and limitations. The results indicate that the sector uncertainty bound can be used effectively to evaluate the impact of parameter uncertainties on the frequency response of the design model. Inherent conservatism is a potential limitation of the sector-based approach, especially for highly dependent uncertain parameters. In addition, the representation of the system dynamics can affect the amount of conservatism reflected in the sector bound. Careful application of the model can help to reduce this conservatism, however, and the solution approach has some degrees of freedom that may be further exploited to reduce the conservatism. H.A.

N92-21440*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MODELING METHODS FOR HIGH-FIDELITY ROTORCRAFT FLIGHT MECHANICS SIMULATION
M. Hossein Mansur, Mark B. Tischler, Menahem Chaimovich, Aviv Rosen, and Omri Rand (Israel Inst. of Tech., Haifa.) Jan. 1992 17 p Presented at the Sixteenth European Rotorcraft Forum, Glasgow, Scotland, 18-20 Sep. 1990
(NASA-TM-103842; A-91080; NAS 1.15:103842; USAAVSCOM-TR-91-A-005) Avail: NTIS HC/MF A03 CSCL 01C

The cooperative effort being carried out under the agreements of the United States-Israel Memorandum of Understanding is discussed. Two different models of the AH-64 Apache Helicopter, which may differ in their approach to modeling the main rotor, are presented. The first model, the Blade Element Model for the Apache (BEMAP), was developed at Ames Research Center, and is the only model of the Apache to employ a direct blade element approach to calculating the coupled flap-lag motion of the blades and the rotor force and moment. The second model was developed at the Technion-Israel Institute of Technology and uses an harmonic approach to analyze the rotor. The approach allows two different levels of approximation, ranging from the 'first harmonic' (similar to a tip-path-plane model) to 'complete high harmonics' (comparable to a blade element approach). The development of the two models is outlined and the two are compared using available flight test data. Author

N92-21752# Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
COMPUTER-AIDED DESIGN OF FLIGHT CONTROL SYSTEMS
Robert F. Stengel and Subrata Sircar 1991 8 p Presented at the AIAA Guidance, Navigation, and Control Conference, New Orleans, LA, 12-14 Aug. 1991 Previously announced in IAA as A91-49645
(Contract DAAL03-89-K-0092)
(AD-A244657; ARO-25264.7-MA) Avail: NTIS HC/MF A02 CSCL 12/5

A comprehensive computer program for designing and evaluating multidisciplinary aircraft flight control systems is described. The FlightCAD program contains a variety of modeling, synthesis, analysis, and simulation alternatives. The program will be used to produce a control design for the 1991 AIAA Controls Design Challenge (to be completed in 1992). FlightCAD ultimately will implement a number of control design techniques; here it uses direct digital synthesis to produce a robust, proportional-integral-filter controller with scheduled linear-quadratic-Gaussian gains and command generator tracking of pilot inputs. The FlightCAD design approach is reviewed, and a status report is presented. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N92-21162*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Transportation Research.
RUNWAY EXIT DESIGNS FOR CAPACITY IMPROVEMENT DEMONSTRATIONS. PHASE 2: COMPUTER MODEL DEVELOPMENT
A. A. Trani, A. G. Hobeika, B. J. Kim, V. Nunna, and C. Zhong 15 Jan. 1992 149 p Sponsored in part by FAA
(Contract NAS1-18471)
(NASA-CR-190166; NAS 1.26:190166; CTR-R-1-92-Phase-2; DOT/FAA/RD-92/6-Phase-2) Avail: NTIS HC/MF A07 CSCL 14B

The development is described of a computer simulation/optimization model to: (1) estimate the optimal locations of existing and proposed runway turnoffs; and (2) estimate the geometric design requirements associated with newly developed high speed turnoffs. The model described, named REDIM 2.0, represents a stand alone application to be used by airport planners, designers, and researchers alike to estimate optimal turnoff locations. The main procedures are described in detail which are implemented in the software package and possible applications are illustrated when using 6 major runway scenarios. The main output of the computer program is the estimation of the weighted average runway occupancy time for a user defined aircraft population. Also, the location and geometric characteristics of each turnoff are provided to the user. Author

N92-21720# Aerospace Medical Research Labs., Brooks AFB, TX.
ANALYSIS OF MEASURED ENVIRONMENTAL NOISE LEVELS: AN ASSESSMENT OF THE EFFECTS OF AIRBASE OPERATIONAL MODEL VARIABLES ON PREDICTED NOISE EXPOSURE LEVELS Final Report, Jul. 1979 - Mar. 1980; Jun. 1989 - Dec. 1990
Wayne R. Lundberg Jun. 1991 268 p
(AF Proj. 7231)
(AD-A244805; AL-TR-1991-0097) Avail: NTIS HC/MF A12 CSCL 14/2

This report presents an exhaustive study of measured noise data collected during a three week period at McChord AFB. The NOISECHECK methodology for comparing noise predictions to measured noise data was used in an effort to quantify the complicating factors relevant to airbase environmental noise prediction. These factors are dominated by parameters of the aircraft operations model. The operational model parameters are segregated and their effects on noise level predictions discussed, using the Probability of Consistency as a measure of their overall impact. It was found that noise generation was very sensitive to relatively small changes in power setting. The operational model of aircraft altitude and track location produced the most significant effects on predicted noise levels. The level of detail analysis attained allowed further assessment of the problems of noise generation and propagation modeling. The detailed NOISECHECK Sound Exposure Level analysis was automated using a database management system, which greatly reduced the effort required to conduct the repeated analyses required for this study. The retrieval and comparison of NOISEMAP noise level predictions were also automated. An accurate approach to estimating the operational parameters needed to model variable aircraft operations was developed and partially validated. GRA

N92-21777# National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
CRITERIA FOR THE OPERATION OF FEDERALLY-OWNED SECONDARY CALIBRATION LABORATORIES (IONIZING RADIATION) Final Report
E. H. Eisenhower Aug. 1991 66 p
(PB92-112481; NIST/SP-812) Avail: NTIS HC/MF A04 CSCL 14B

Given here are standards of performance for laboratories that calibrate instrumentation used to measure ionizing radiation. Such standards are useful for the development of a secondary level of calibration laboratories that can provide a high-quality link between the National Institute of Standards and Technology and those who make routine measurements at the field level. The standards may also be used as criteria on which a decision is based regarding accreditation of a particular laboratory. They were developed by representatives of federally-owned laboratories that perform calibrations of the type addressed by the document. General criteria that must be satisfied by all laboratories seeking accreditation are noted, as well as requirements relating to management and staff, physical aspects of the laboratory, calibration facilities and equipment, operational procedures, accuracy and quality assurance, and records and reports. Criteria are established for calibration of survey instruments, irradiation of personnel dosimeters, calibration of sources, calibration of instruments for diagnostic levels, and calibration of reference-class instruments. The types of radiation covered include gamma rays, x rays, beta particles, neutrons, and alpha particles. The proficiency tests administered by NIST to secondary laboratories as a prerequisite for their accreditation are described. Author

N92-21870# National Inst. of Standards and Technology, Gaithersburg, MD. Public Affairs Div.
RESEARCH, SERVICES, AND FACILITIES (NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY)
M. A. Bello, G. Porter, and S. A. Shaffer Aug. 1991 92 p
(PB92-109172; NIST/SP-817) Avail: NTIS HC/MF A05; also available SOD HC $4.75 as 003-003-03098-8 CSCL 14B

Described here is the full spectrum of National Institute of Standards and Technology (NIST) programs and facilities available for industry participation and use. Each item includes the name and telephone number of an NIST program manager or researcher to contact for more information. Specific topics covered include gaining the competitive edge, serving the customer, technology services, the Electronics and Electrical Engineering Laboratory, the Manufacturing Engineering Laboratory, the Chemical Science and Technology Laboratory, the Physics Laboratory, the Materials Science and Engineering Laboratory, the Building and Fire Research Laboratory, the Computer Systems Laboratory, the Computing and Applied Mathematics Laboratory, a facilities index, and a subject index. Author

N92-21511# Wichita State Univ., KS. Dept. of Aerospace Engineering.
THE FLIGHT SIMULATION FACILITY AT THE WICHITA STATE UNIVERSITY Abstract Only
Stephen G. McCauley *In its* Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N92-21177*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-48, POSTFLIGHT EDITION
Guy E. Clatterbuck and William C. Hill (Vitro Corp., Washington, DC.) 16 Dec. 1991 120 p
(NASA-TM-107771; NAS 1.15:107771) Avail: NTIS HC/MF A06 CSCL 21A

Space Shuttle Discovery was launched into a 57 deg inclination orbit from the Kennedy Space Center (KSC) Launch Complex 39A at 7:11 p.m. EDT on 12 Sep. 1991. STS-48 was the second mission since return-to-flight to have KSC as the planned end-of-mission landing site, and the first mission to have a planned night landing at KSC. However, due to weather conditions at KSC, Discovery flew one extra orbit and landed at Edwards AFB, Calif. at 3:38 a.m. EDT on 18 Sep. 1991. Operation of all systems was generally satisfactory during the 5 day mission. On flight day 3, the Upper Atmospheric Research Satellite (UARS) was deployed from Discovery's payload bay 350 statute miles above Earth. This orbiting observatory will study mankind's effects on the planet's atmosphere and its shielding ozone layer. STS-48 safety risk factors are addressed that represent a change from previous flights, factors from previous flights that had an impact on this flight, and factors that are unique to this flight. Author

N92-21178*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-39, POSTFLIGHT EDITION
Kenneth O. Hardie, William C. Hill, and Seymour I. Finkel (Vitro Corp., Washington, DC.) 30 Aug. 1991 140 p
(NASA-TM-107781; NAS 1.15:107781) Avail: NTIS HC/MF A07 CSCL 22A

After a delay of approximately 2 months due to a rollback from the pad to replace the External Tank door lug housing, Space Shuttle Discovery was launched from NASA-Kennedy at 7:33 a.m. Eastern Daylight Time on 28 April 1991. STS-39 was the first unclassified DoD Shuttle mission. On 28 April, countdown proceeded normally through the T-20 minute hold. No significant problems were encountered except for the Operations Sequence-2 recorder starting unexpectedly; it was stopped by an uplink command. Discovery landed on KSC runway 15 at 2:55 p.m. EDT on 6 May 1991. This was the second time in 6 months that the Space Shuttle was diverted to KSC for landing because of high winds at Edwards AFB, Calif. This was also the 7th of 40 Shuttle missions to land at KSC in the history of the Space Shuttle Program.

The Main Landing Gear outer right tire shredded 3 of the 16 cords due to either an uneven landing or a maximum force breaking test during rollout. Contributing factors to the tire cord shredding were the development of last minute crosswinds and reluctance of the ground controllers to distract the Shuttle pilots with warnings of the low flight path. As a corrective action, communication procedures will be modified for future flights. Author

N92-21179*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-38, POSTFLIGHT EDITION
William C. Hill and Seymour I. Finkel (Vitro Corp., Washington, DC.) 21 Dec. 1990 156 p
(NASA-TM-107782; NAS 1.15:107782) Avail: NTIS HC/MF A08 CSCL 22A

After several months delay due to Liquid Hydrogen (LH2) leaks in the External Tank (ET) 17 in LH2 umbilical disconnect, Atlantis was launched at 6:48 p.m. Eastern Standard Time on 15 Nov. 1990. Atlantis was cleared for launch after the replacement of the ET 17 in umbilical disconnect and a successful tanking test on 24 Oct. 1990. No technical concerns were encountered during the countdown. The end of the STS-38 mission was extended by one day because of high crosswinds at the primary landing site, Edwards Air Force Base (EAFB), Calif. On the next day, 20 Nov. 1990, the winds were too high for a safe landing at EAFB, and a decision was made to select the Shuttle Landing Facility (SLF) at the Kennedy Space Center (KSC) at the primary landing site. The deorbit burn was performed on orbit 79 of the STS-38 mission. Reentry and descent were effected with no problems. Postlanding inspection of Atlantis' exterior found little evidence of damage. There has been a concern about returning an Orbiter to KSC, because the last mission to do so experienced tire failure. Atlantis' tires and brakes were in excellent condition with no indication of excessive wear. Author

N92-21377*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-37, POSTFLIGHT EDITION
William C. Hill and Seymour I. Finkel (Vitro Corp., Washington, DC.) 14 Jun. 1991 118 p
(NASA-TM-107783; NAS 1.15:107783) Avail: NTIS HC/MF A06 CSCL 22A

STS-37/Atlantis was launched on April 5, 1991 from Kennedy Space Center launch complex 39B at 9:23 a.m. Eastern Standard Time (EST). Launch was delayed 4 minutes 45 seconds because of safety concerns about the low cloud ceiling and the wind direction in the potential blast area. Based on the limited number and type of inflight anomalies encountered, the Space Shuttle operated satisfactorily throughout the STS-37 mission. A contingency EVA was performed by the crew on Flight Day (FD) 3 to free a sticky Gamma Ray Observatory (GRO) high gain antenna, after which the GRO primary payload was successfully deployed by the Orbiter's Remote Manipulator System. The GRO, which weighed just over 35,000 lbs, was the heaviest NASA science satellite ever deployed by the Space Shuttle into low Earth orbit. The scheduled entry/landing on FD 6 was waved off for one day due to high wind conditions at Edwards Air Force Base. Atlantis landed on FD 7, 11 April 1991 on Edwards AFB lakebed runway 33 at 9:55 a.m. Eastern Daylight Time. Author

N92-21516*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-31, POSTFLIGHT EDITION
William C. Hill, Kenneth O. Hardie, and Seymour I. Finkel (Vitro Corp., Washington, DC.) 15 Oct. 1990 140 p
(NASA-TM-107776; NAS 1.15:107776) Avail: NTIS HC/MF A07 CSCL 22A

Mission safety factors relative to Space Transportation System (STS) Mission 31 are discussed. In addition to a mission summary, safety risk factors and inflight anomalies are discussed. Author

N92-21541*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-40, POSTFLIGHT EDITION
William C. Hill and Seymour I. Finkel (Vitro Corp., Washington, DC.) 1 Oct. 1991 128 p
(NASA-TM-107768; NAS 1.15:107768) Avail: NTIS HC/MF A07 CSCL 22A

Mission safety factors relative to Space Transportation System (STS) Mission 40 are discussed. In addition to a mission summary, safety risk factors and inflight anomalies are discussed. Author

N92-21542*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-41, POSTFLIGHT EDITION
William C. Hill, Kenneth O. Hardie, and Seymour I. Finkel (Vitro Corp., Washington, DC.) 15 Nov. 1990 114 p
(NASA-TM-107769; NAS 1.15:107769) Avail: NTIS HC/MF A06 CSCL 22A

Mission safety factors relative to the Space Transportation System (STS) Mission 41 are discussed. In addition to a mission summary, safety risk factors and inflight anomalies are discussed. Author

N92-21543*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-28, POSTFLIGHT EDITION
Seymour I. Finkel (Vitro Corp., Washington, DC.) 14 Nov. 1989 115 p
(NASA-TM-107772; NAS 1.15:107772) Avail: NTIS HC/MF A06 CSCL 22A

Mission safety factors relative to Space Transportation System (STS) Mission 28 are discussed. In addition to a mission summary, safety risk factors and inflight anomalies are discussed. Author

N92-21544*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-34, POSTFLIGHT EDITION
William C. Hill (Vitro Corp., Washington, DC.) 2 Jan. 1990 141 p
(NASA-TM-107777; NAS 1.15:107777) Avail: NTIS HC/MF A07 CSCL 22A

Mission safety factors relative to Space Transportation System (STS) Mission 34 are discussed. In addition to a mission summary, safety risk factors and inflight anomalies are discussed. Author

N92-22089# National Space Development Agency, Tokyo (Japan).
PREPRINTS OF NASDA'S 5TH TECHNICAL SYMPOSIUM
1 Jun. 1990 194 p In ENGLISH and JAPANESE Symposium held in Tokyo, Japan, 1 Jun. 1990
(JTN-92-80273) Avail: NTIS HC/MF A09

Topics addressed include: space processing, microgravity experiment rocket, low gravity manufacturing, spaceborne experiments, manned orbital laboratories, environmental laboratories, ground test facilities, environmental tests, communications technology satellite, spacecraft performance, spacecraft antennas, satellite antennas, deployable antennas, semiconductor devices, radiation hardening, space station payloads, spacecraft models, satellite models, spacecraft structures, load tests, vibration tests, shock tests, marine observation satellite, satellite-borne instruments, and extraterrestrial radiation. For individual titles, see N92-22090 through N92-22095.

N92-22090# National Space Development Agency, Tokyo (Japan). Launch Vehicle Group.
OUTLINE OF THE MICROGRAVITY EXPERIMENT ROCKET (TR-1A) c15
Jiro Kochiyama *In its* Preprints of NASDA's 5th Technical

Symposium 1 Jun. 1990 p 1-30 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

In 1989, the National Space Development Agency of Japan (NASDA) decided to conduct the space processing experiment project, using the new microgravity experiment rocket (TR-1A), for the effective utilization of the Japanese Experiment Module, one part of the international space station. The project goal is to obtain the basic know-how of microgravity experiments and experimental devices through the flight opportunity of TR-1A (Test Rocket-1A) rocket. This TR-1A rocket can project a 1500 kg gross payload to about 270 km altitude and remain in a free fall condition about six minutes or more. Obtained microgravity condition is less than 10(exp -9)G. The first flight will be held in 1991, and now the development of the rocket and experimental devices are ongoing. This report describes an outline of the microgravity experiment rocket (TR-1A) and its standing point and prospect in the test rocket family. Author (NASDA)

N92-22091# National Space Development Agency, Tokyo (Japan). Space Experiment Group.
DEVELOPMENT OF FMPT (FUWATTO 1991) **c29**
Norio Soichi *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 31-63 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

The First Material Processing Test (FMPT) is Japan's first experience in conducting manned space experiments. Twenty-two material science experiments and twelve life science experiments were selected and have been developed for the flight using the Space Shuttle/Spacelab module. Major instrument systems have been developed by the National Space Development Agency of Japan (NASDA) and will be installed in three double racks. The Shuttle, on which a Japanese Payload Specialist (PS) will conduct experiments for the first time with some American crew members, is scheduled to be launched on 17 Jun. 1991. Experiments and flight hardwares are fully developed, and FMPT seems to be a good example and precedent for future space environment utilization. Author (NASDA)

N92-22092# National Space Development Agency, Tokyo (Japan). Environmental and Structural Test Dept.
SPACECRAFT INTEGRATION AND TEST FACILITIES AT TSUKUBA SPACE CENTER **c14**
Senjiro Iide and Mitsuhiro Tsuchiya *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 65-89 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

In order to perform the development test of large scale test objects such as large satellites, manned space station, space planes, and so on, launched on the H-2 Rocket, the National Space Development Agency of Japan (NASDA) built the Spacecraft Integration and Test Building (SITE) during fiscal years 1986 and 1989. An outline of the constructing details and the specifications of these test facilities are presented, and the operating situation after construction including results of the facilities' test data are provided. Author (NASDA)

N92-22093# National Space Development Agency, Tokyo (Japan). Engineering Test Satellite Group.
DEVELOPMENT TEST RESULTS OF ETS-6 STRUCTURAL DEVELOPMENT MODEL **c18**
Akio Tsujihata *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 91-122 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

The Engineering Test Satellite-6 (ETS-6) is a two-ton-class three-axis-stabilized geostationary spacecraft and was developed to be launched in Summer 1993 by the H-2 Launch Vehicle. For the ETS-6 structural development, full-scale structural development models were fabricated in accordance with the basic design results and tests were performed. Those are Structural Development Model-Static (SDM-S) and Structural Development Model-Dynamic (SDM-D). The objective of the SDM-S is to verify the strength of structure and the SDM-D is to verify the evaluation of mechanical environments. This paper presents a summary of the ETS-6 SDM and the results of the development test. The results of the development test provided useful test data to evaluate the design, the manufacture, and the test procedure for the protoflight model. Author (NASDA)

N92-22094# National Space Development Agency, Tokyo (Japan). Tsukuba Space Center.
RESEARCH AND DEVELOPMENT ON LARGE DEPLOYABLE ANTENNA **c18**
Yasumasa Hisada *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 123-157 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

This paper describes the ground deployment test of a synthetic aperture radar (SAR) antenna and a five meter diameter petal deployable antenna under research and development by the National Space Development Agency of Japan (NASDA). The SAR antenna will be mounted on Earth Resources Satellite-1 (ERS-1) and the five meter diameter petal deployment antenna will be mounted on a Tracking and Data Relay (TDRS) Satellite. This paper especially describes the policy on research and development of a large deployable antenna in NASDA, and the ground deployment test results of these two antennas are also introduced. Author (NASDA)

N92-22095# National Space Development Agency, Tokyo (Japan). Parts and Material Lab.
THE ENGINEERING SOLUTIONS TO THE PROBLEM OF SPACE RADIATION EFFECTS IN SEMICONDUCTOR DEVICES **c33**
Tateo Goka and Sigeru Ikeda *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 159-187 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

This report presents radiation hardening techniques which have been newly developed by National Space Development Agency of Japan (NASDA) to provide engineering solutions to the problem of space radiation effects. The new developments include a program for calculating of total dose and for predicting the probability of Single Event Upset (SEU) using space radiation model, irradiation and evaluation tests, and development of radiation hardened Large Scale Integrated Circuit (LSI) devices. Also, this report presents engineering solutions which have been applied to Marine Observation Satellite-1b (MOS-1b) and the MOS-1b mission launch operations to the problem of SEU phenomena of MOS-1 satellite. Author (NASDA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N92-21372*# University of Central Florida, Orlando. Dept. of Mechanical and Aerospace Engineering.

DESIGN, BUILDING, AND TESTING OF THE POST LANDING SYSTEMS FOR THE ASSURED CREW RETURN VEHICLE Final Report

Loren A. Anderson 1991 252 p

(Contract NASw-4435)

(NASA-CR-189977; NAS 1.26:189977) Avail: NTIS HC/MF A12 CSCL 22D

The design, building, and testing of the post landing support systems for a water landing Assured Crew Return Vehicle (ACRV) are presented. One ACRV will be permanently docked to Space Station Freedom, fulfilling NASA's commitment to Assured Crew Return Capability in the event of an accident or illness. The configuration of the ACRV is based on an Apollo Command Module (ACM) derivative. The 1990 to 91 effort concentrated on the design, building, and testing of a 1/5 scale model of the egress and stabilization systems. The objective was to determine the feasibility of: (1) stabilizing the ACM out of the range of motions which cause sea sickness; and (2) the safe and rapid removal of a sick or injured crewmember from the ACRV. The ACRV model construction is presented along with a discussion of the water test facility. The rapid egress system is also presented along with a discussion of the ACRV stabilization control systems. Results are given and discussed in detail. Author

N92-22092# National Space Development Agency, Tokyo (Japan). Environmental and Structural Test Dept.

SPACECRAFT INTEGRATION AND TEST FACILITIES AT TSUKUBA SPACE CENTER

Senjiro Iide and Mitsuhiro Tsuchiya *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 65-89 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)

Avail: NTIS HC/MF A09

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N92-21344*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

FINAL DESIGN REPORT OF A PERSONNEL LAUNCH SYSTEM AND A FAMILY OF HEAVY LIFT LAUNCH VEHICLES

James Tupa, Debbie Merritt, David Riha, Lee Burton, Russell Kubinski, Kerry Drake, Darrin Mann, and Ken Turner 6 May 1991 116 p

(Contract NASw-4435)

(NASA-CR-190013; NAS 1.26:190013) Avail: NTIS HC/MF A06 CSCL 22B

The objective was to design both a Personnel Launch System (PLS) and a family of Heavy Lift Launch Vehicles (FHLLVs) that provide low cost and efficient operation in missions not suited for the Shuttle. The PLS vehicle is designed primarily for space station crew rotation and emergency crew return. The final design of the PLS vehicle and its interior is given. The mission of the FHLLVs is to place large, massive payloads into Earth orbit with payload flexibility being considered foremost in the design. The final design of three launch vehicles was found to yield a payload capacity range from 20 to 200 mt. These designs include the use of multistaged, high thrust liquid engines mounted on the core stages of the rocket. Author

N92-21547*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

MISSION AND SIZING ANALYSIS FOR THE BETA 2 TWO-STAGE-TO-ORBIT VEHICLE

Shari-Beth Nadell, William J. Baumgarten, and Stephen W. Alexander 1992 15 p Presented at the 1992 Aerospace Design Conference, Irvine, CA, 3-6 Feb. 1992; sponsored by AIAA

(NASA-TM-105559; E-6883; NAS 1.15:105559; AIAA-92-1264)

Avail: NTIS HC/MF A03 CSCL 22B

NASA Lewis Research Center studied a horizontal takeoff and landing, fully reusable, two-stage-to-orbit (TSTO) vehicle capable of launching and returning a 10,000 pound payload to low Earth polar orbit using low-risk technology. The vehicle, called Beta 2, was derived from the USAF/Boeing Beta vehicle, a TSTO study vehicle capable of launching a 50,000 pound payload to low Earth polar orbit. Development of the Beta 2 from the USAF/Boeing Beta vehicle occurred in a series of iterations during which the size of the vehicle was decreased to accommodate the smaller payload, the staging Mach number was decreased from 8.0 to 6.5, and the rocket propulsion system was removed from the booster. The final Beta 2 vehicle consisted of a rocket powered orbiter and an all airbreathing booster. The gross takeoff weight of the Beta 2 vehicle was approximately 1.1 million pounds. In addition to its baseline mission, the Beta 2 was capable of delivering approximately 17,500 pounds to the Space Station with the same takeoff gross weight. The mission and sizing analysis performed to arrived at the Beta 2 vehicle is discussed. Author

N92-21849# Rolls-Royce Ltd., Bristol (England).

HIGH ENERGY X RAY FOR THE ARIANE 5 PROGRAMME

N. J. Townsend and S. Bruni (Bombrini Parodi-Delfino S.p.A., Colleferro, Italy) 15 Nov. 1990 8 p

(PNR-90831; ETN-92-90787) Copyright Avail: NTIS HC/MF A02

The technical solutions available for real-time X ray systems are examined. A theoretical performance evaluation is used to identify the system most appropriate for the Ariane program. The practical implementation of the preferred solution is discussed and problem areas highlighted. Image processing and data handling techniques are also examined. Other possible applications of similar and related technology are also considered. ESA

N92-22090# National Space Development Agency, Tokyo (Japan). Launch Vehicle Group.

OUTLINE OF THE MICROGRAVITY EXPERIMENT ROCKET (TR-1A)

Jiro Kochiyama *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 1-30 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)

Avail: NTIS HC/MF A09

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N92-21245*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

SUNMASTER: AN SEP CARGO VEHICLE FOR MARS MISSIONS

Aleasa Chiles, Jennifer Fraser, Andy Halsey, David Honeycutt, Michael Madden, Brian McGough, David Paulsen, Becky Spear, Lynne Tarkenton, and Kevin Westley Jun. 1991 132 p Original

contains color illustrations
(Contract NASw-4435)
(NASA-CR-189995; NAS 1.26:189995) Avail: NTIS HC/MF A07; 3 functional color pages CSCL 22B

Options are examined for an unmanned solar powered electric propulsion cargo vehicle for Mars missions. The 6 prime areas of study include: trajectory, propulsion system, power system, supporting structure, control system, and launch consideration. Optimization of the low thrust trajectory resulted in a total round trip mission time just under 4 years. The argon propelled electrostatic ion thruster system consists of seventeen 5 N engines and uses a specific impulse of 10,300 secs. At Earth, the system uses 13 engines to produce 60 N of thrust; at Mars, five engines are used, producing 25 N thrust. The thrust of the craft is varied between 60 N at Earth and 24 N at Mars due to reduced solar power available. Solar power is collected by a Fresnel lens concentrator system using a multistacked cell. This system provides 3.5 MW to the propulsion system after losses. Control and positioning to the craft are provided by a system of three double gimballed control moment gyros. Four shuttle 'C' launches will be used to transport the unassembled vehicle in modular units to low Earth orbit where it will be assembled using the Mobile Transporter of the Space Station Freedom. Author

N92-21371*# Maryland Univ., College Park. Dept. of Aerospace Engineering.
DART: DELTA ADVANCED REUSABLE TRANSPORT. AN ALTERNATE MANNED SPACE SYSTEM PROPOSAL Final Report
13 May 1991 349 p
(Contract NASw-4435)
(NASA-CR-189978; NAS 1.26:189978) Avail: NTIS HC/MF A15 CSCL 22B

The Delta Advanced Reusable Transport (DART) craft is being developed to add, multiple, rapid, and cost effective space access to the U.S. capability and to further the efforts towards a permanent space presence. The DART craft provides an augmentative and an alternative system to the Shuttle. As a supplement launch vehicle, the DART adds low cost and easily accessible transport of crew and cargo to specific space destinations to the U.S. program. This adds significant opportunities for manned rated missions that do not require Shuttle capabilities. In its alternative role, the DART can provide emergency space access and satellite repair, the continuation of scientific research, and the furthering of U.S. manned efforts in the event of Shuttle incapabilities. In addition, the DART is being designed for Space Station Freedom compatibility, including its use as a 'lifeboat' emergency reentry craft for Freedom astronauts, as well as the transport of crew and cargo for station resupply. Author

N92-21265*# Florida International Univ., Miami. Dept. of Industrial Engineering.
USE OF TAGUCHI DESIGN OF EXPERIMENTS TO DETERMINE ALPLS ASCENT DELTA-5 SENSITIVITIES AND TOTAL MASS SENSITIVITIES TO RELEASE CONDITIONS AND VEHICLE PARAMETERS Final Report
Hector Ramon Carrasco *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 12 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

N92-21268*# Houston Univ., TX. Dept. of Industrial Engineering.
AN EXPLORATORY EXERCISE IN TAGUCHI ANALYSIS OF DESIGN PARAMETERS: APPLICATION TO A SHUTTLE-TO-SPACE STATION AUTOMATED APPROACH CONTROL SYSTEM Final Report
Don E. Deal *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 10 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N92-21361# Naval Postgraduate School, Monterey, CA.
DEVELOPMENT OF AN NPS MIDDLE ULTRAVIOLET SPECTROGRAPH (MUSTANG) ELECTRONIC INTERFACE M.S. Thesis
John H. Quint Dec. 1991 274 p
(AD-A244672) Avail: NTIS HC/MF A12 CSCL 14/2

This thesis developed a robust electronic interface package for the Naval Postgraduate School (NPS) Middle Ultraviolet Spectrograph (MUSTANG) experiment. The MUSTANG instrument was designed to observe atmospheric emissions in the 1800 to 3400 A wavelength region. MUSTANG has flown along with a Naval Research Laboratory (NRL) instrument on a NASA sounding rocket experiment, and is scheduled to fly on two more sounding rockets prior to integration on an Air Force satellite. Data from these experiments will test a new technique for measuring global ionospheric electron densities on a real-time basis. The electronic interface links the MUSTANG instrument with the Aydin Vector MMP-600 Series Pulse Code Modulation Encoder in the sounding rocket telemetry section. Analog data from MUSTANG is digitized and buffered in the electronic interface to support asynchronous transfer to telemetry. Digitized MUSTANG data is telemetered to a ground station during rocket flight. This electronic interface circuit was thoroughly tested during payload integration with NASA. Ground Support Equipment (GSE) was extensively revised to support the MUSTANG instrument during lab calibration and launch site testing. GRA

N92-22001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ADVANCED MODULATION AND CODING TECHNOLOGY CONFERENCE
Feb. 1992 324 p Conference held in Cleveland, OH, 21-22 Jun. 1989
(NASA-CP-10053; E-5535; NAS 1.55:10053) Avail: NTIS HC/MF A14 CSCL 17B

The objectives, approach, and status of all current LeRC-sponsored industry contracts and university grants are presented. The following topics are covered: (1) the LeRC Space Communications Program, and Advanced Modulation and Coding Projects; (2) the status of four contracts for development of proof-of-concept modems; (3) modulation and coding work done under three university grants, two small business innovation research contracts, and two demonstration model hardware development contracts; and (4) technology needs and opportunities for future missions. For individual titles, see N92-22002 through N92-22022.

N92-22002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NASA. LEWIS RESEARCH CENTER ADVANCED MODULATION AND CODING PROJECT: INTRODUCTION AND OVERVIEW
James M. Budinger *In its* Advanced Modulation and Coding Technology Conference Feb. 1992 p 7-30 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

The Advanced Modulation and Coding Project at LeRC is sponsored by the Office of Space Science and Applications, Communications Division, Code EC, at NASA Headquarters and conducted by the Digital Systems Technology Branch of the Space Electronics Division. Advanced Modulation and Coding is one of three focused technology development projects within the branch's overall Processing and Switching Program. The program consists of industry contracts for developing proof-of-concept (POC) and demonstration model hardware, university grants for analyzing

advanced techniques, and in-house integration and testing of performance verification and systems evaluation. The Advanced Modulation and Coding Project is broken into five elements: (1) bandwidth- and power-efficient modems; (2) high-speed codecs; (3) digital modems; (4) multichannel demodulators; and (5) very high-data-rate modems. At least one contract and one grant were awarded for each element. Author

N92-22003*# Ford Aerospace Corp., Palo Alto, CA. Space Systems Div.
AN 8-PSK CODED TDMA SATELLITE DEMODULATOR
S. A. Ames *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 33-50 (For primary document see N92-22001 12-17)
(Contract NAS3-24678)
Avail: NTIS HC/MF A14 CSCL 17B

The objectives of this project are: (1) to develop a proof-of-concept (POC) uplink modulation system which will significantly increase the bandwidth efficiency of a time division multiple access (TDMA) uplink system; (2) to maintain present performance levels; and (3) to ensure that the POC model exhibit potential for low weight and low power consumption. Other aspects of this project are presented in view graph form. K.S.

N92-22004*# TRW Electronic Systems Group, Redondo Beach, CA.
RATE 3/4 CODED 16-QAM FOR UPLINK APPLICATIONS
Eric M. Mrozek and Jerry K. N. Wong *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 51-65 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

First phase development of an advanced modulation technology which synergistically combines coding and modulation to achieve 2 bits per second per Hertz bandwidth efficiency in satellite demodulators is nearing completion. A proof-of-concept model is being developed to demonstrate technology feasibility, establish practical bandwidth efficiency limitations, and provide a data base for the design and development of engineering model satellite demodulators. The basic considerations leading to the choice of 4 x 4 quadrature amplitude modulation (16-QAM) and its associated coding format are discussed, along with the basic implementation of the carrier and clock recovery, automatic gain control, and decoding process. Preliminary performance results are presented. Spectra for the modulated signal shows the effects of the square root Nyquist filters in the modulation. Bit error rate (BER) results for the encoder/decoder subsystem show near ideal results, although power consumption is high and baseband BER performance of the Nyquist filter set is poor. Recommendations regarding the present system to improve BER performance and acquisition speed are given. Author

N92-22005*# Ford Aerospace Corp., Palo Alto, CA. Space Systems Div.
AN 8-PSK TDMA UPLINK MODULATION AND CODING SYSTEM
S. A. Ames *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 67-91 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

The combination of 8-phase shift keying (8PSK) modulation and greater than 2 bits/sec/Hz drove the design of the Nyquist filter to one specified to have a rolloff factor of 0.2. This filter when built and tested was found to produce too much intersymbol interference and was abandoned for a design with a rolloff factor of 0.4. The preamble is limited to 100 bit periods of the uncoded bit period of 5 ns for a maximum preamble length of 500 ns or 40 8PSK symbol times at 12.5 ns per symbol. For 8PSK modulation, the required maximum degradation of 1 dB in -20 dB cochannel interference (CCI) drove the requirement for forward error correction coding. In this contract, the funding was not sufficient to develop the proposed codec so the codec was limited to a paper design during the preliminary design phase. The mechanization of the demodulator is digital, starting from the output of the analog to digital converters which quantize the outputs of the quadrature phase detectors. This approach is amenable to an application specific integrated circuit (ASIC) replacement in the next phase of development. Author

N92-22006*# Communications Satellite Corp., Clarksburg, MD.
RATE 8/9 CODED 8-PSK SYSTEM FOR DOWNLINK APPLICATIONS
Russell Fang, Mark Kappes, and Susan Miller *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 93-125 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

An advanced Coded Trellis Modulation (CTM) System which achieves a 2 bits/s/Hz bandwidth efficiency at an information rate of 200 Mbit/s while minimizing satellite power requirements, was developed for downlink earth station applications. The CTM system employs a high-speed rate 8/9 convolutional code with Viterbi decoding and an 8-Phase Shift Keying (PSK) modem. The minimum Euclidean distance between the modulated waveforms corresponding to the information sequences are maximized in order to maximize the noise immunity of the system. Nyquist filters with a square-root of 40 percent roll-off are used at the transmit and receive sides of the modem in order to minimize intersymbol interference, adjacent channel interference, and distortion at the nonlinear satellite power amplifier. The use of a coded system here also minimizes the effects of co-channel interference. The developed performance of the hardware system was measured to achieve within 1.5 dB from theory at a bit error rate of 5 x 10(exp -7) over an additive white Gaussian noise channel. Author

N92-22007*# Harris Corp., Melbourne, FL. Advanced Technology Dept.
CODED 16-CPFSK FOR DOWNLINK APPLICATIONS
Robert Davis *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 127-136 (For primary document see N92-22001 12-17)
(Contract NAS3-24681)
Avail: NTIS HC/MF A14 CSCL 17B

A bandwidth-efficient constant-envelope Proof-of-Concept (POC) modem is described. The modem was developed on an Advanced Modulation Techniques Development contract for the NASA/Lewis Research Center. The POC modem employs 16-ary Continuous Phase Frequency Shift Keying (16-CPFSK) modulation. The 16 frequencies are spaced every 1/16th baud rate which produces a compact spectrum allowing 2 bits/sec/Hz operation. The modem is designed for 200 mb/s Time Division Multiple Access (TDMA) application with 100 MHz adjacent channel spacing. Overall rate 3.4 convolutional coding is incorporated. The demodulator differs significantly from typical quadrature phase detector approaches in that phase is coherently measured by processing the baseband output of a frequency discriminator. Baud rate phase samples for the baseband processor are subsequently decoded to yield the original data stream. The method of encoding onto the 16-ary symbol-ending phase nodes, together with convolutional coding gain, results in near Quadrature Phase Shift Keying (QPSK) theoretical performance. The modulated signal is of constant envelope; thus the power amplifier can be saturated for peak performance. The spectrum is inherently bandlimited and requires no RF filter for sidelobe containment. Two novel theoretical techniques are used in this 16-CPFSK modem: (1) coherent phase measurements are obtained by processing an FM discriminator baseband output; and (2) modulation is accomplished via a closed-loop-linearized voltage controlled oscillator (VCO). Author

N92-22008*# Toledo Univ., OH. Dept. of Electrical Engineering.
HIGH SPEED HARDWARE DEVELOPMENT FOR FDMA/TDM SYSTEM
S. C. Kwatra and M. M. Jamali *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 139-148 (For primary document

see N92-22001 12-17)
(Grants NAG3-799; NAG3-865)
Avail: NTIS HC/MF A14 CSCL 17B

The development of a transmultiplexor and a quadrature phase shift keying (QPSK) demodulator is discussed. The system is designed to meet real time signal processing requirements of future satellite systems and should consume very little power. The architectures of the transmultiplexor and the demodulator are designed for the pipelining of all the modules, namely the commutator, the filter bank fast fourier transform (FFT), and the internal modules of the QPSK. The architecture is designed for the case of 800 channels. Each channel is to have a bandwidth of 45 KHz and a bit rate of 64 Kb/s. In this case each module will have 22.22 micro seconds to complete a computation.

Author

N92-22009*# University of Southern California, Los Angeles.
A CO-DESIGNED EQUALIZATION, MODULATION, AND CODING SCHEME
Robert E. Peile *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 149-165 (For primary document see N92-22001 12-17)
(Grant NAG3-982)
Avail: NTIS HC/MF A14 CSCL 17B

The commercial impact and technical success of Trellis Coded Modulation seems to illustrate that, if Shannon's capacity is going to be neared, the modulation and coding of an analogue signal ought to be viewed as an integrated process. More recent work has focused on going beyond the gains obtained for Average White Gaussian Noise and has tried to combine the coding/modulation with adaptive equalization. The motive is to gain similar advances on less perfect or idealized channels.

Author

N92-22010*# California Univ., Davis. Dept. of Electrical Engineering and Computer Science.
MODULATION TECHNIQUES FOR POWER AND SPECTRALLY EFFICIENT SATCOM SYSTEMS
Kamilo Feher *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 167-175 (For primary document see N92-22001 12-17)
(Grant NAG3-1007)
Avail: NTIS HC/MF A14 CSCL 17B

Research on modulation/demodulation (modem) techniques which leads to improved power and spectrally efficient digital satellite communications systems is proposed. A new family of digital modems, which enable satellite earth station and satellite transponder operation with fully saturated high power amplifiers (HPA) in an adjacent channel environment, having an optimized P(e) = f(E(sub b)/N(sub o)) performance will be introduced and analyzed.

Author

N92-22011*# TIW Systems, Inc., Sunnyvale, CA.
PROGRAMMABLE RATE MODEM UTILIZING DIGITAL SIGNAL PROCESSING TECHNIQUES
Arad Naveh *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 177-199 (For primary document see N92-22001 12-17)
(Contract NAS3-25336)
Avail: NTIS HC/MF A14 CSCL 17B

The need for a Programmable Rate Digital Satellite Modem capable of supporting both burst and continuous transmission modes with either Binary Phase Shift Keying (BPSK) or Quadrature Phase Shift Keying (QPSK) modulation is discussed. The preferred implementation technique is an all digital one which utilizes as much digital signal processing (DSP) as possible. The design trade-offs in each portion of the modulator and demodulator subsystem are outlined.

Author

N92-22012*# Amerasia Technology, Inc., Westlake Village, CA.
MULTI-USER SATELLITE COMMUNICATIONS SYSTEM USING AN INNOVATIVE COMPRESSIVE RECEIVER
Edward J. Staples *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 201-210 (For primary document see N92-22001 12-17)
(Contract NAS3-25617)
Avail: NTIS HC/MF A14 CSCL 17B

There is a need for an onboard simultaneous multi-channel demodulation system for a satellite communications system. Studies indicate that Convolve Multiply Convolve (CMC) filtering with surface acoustic wave (SAW) dispersive delay lines will eliminate the necessity of onboard satellite channelized filters of complex fourier transform processors. The reason for choosing the CMC technique is its ability to perform Fourier transformations in a shorter time with less space and power consumption than digital Fourier transform processors. Each ground terminal in this multi-users communications system is remotely located and operates independently; hence, a method of synchronizing the transmission of these users is presented which utilizes the existing Global Positioning System (GPS) system. Each ground user is equipped with a low cost ground terminal that has a synchronization subsystem attached to it. The system design of an onboard Multi-channel Receiver and Demodulator utilizes Quadrature Phase Shift Keying (QPSK) as the modulation technique. This technique provides the best figure of merit, i.e., the lowest transmitter power requirement per communication channel.

Author

N92-22013*# Harris Corp., Melbourne, FL. Government Systems Sector.
FLEXIBLE HIGH SPEED CODEC
R. W. Boyd and W. F. Hartman *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 211-217 (For primary document see N92-22001 12-17)
(Contract NAS3-25087)
Avail: NTIS HC/MF A14 CSCL 17B

The project's objective is to develop an advanced high speed coding technology that provides substantial coding gains with limited bandwidth expansion for several common modulation types. The resulting technique is applicable to several continuous and burst communication environments. Decoding provides a significant gain with hard decisions alone and can utilize soft decision information when available from the demodulator to increase the coding gain. The hard decision codec will be implemented using a single application specific integrated circuit (ASIC) chip. It will be capable of coding and decoding as well as some formatting and synchronization functions at data rates up to 300 megabits per second (Mb/s). Code rate is a function of the block length and can vary from 7/8 to 15/16. Length of coded bursts can be any multiple of 32 that is greater than or equal to 256 bits. Coding may be switched in or out on a burst by burst basis with no change in the throughput delay. Reliability information in the form of 3-bit (8-level) soft decisions, can be exploited using applique circuitry around the hard decision codec. This applique circuitry will be discrete logic in the present contract. However, ease of transition to LSI is one of the design guidelines. Discussed here is the selected coding technique. Its application to some communication systems is described. Performance with 4, 8, and 16-ary Phase Shift Keying (PSK) modulation is also presented.

Author

N92-22014*# Communications Satellite Corp., Clarksburg, MD.
PROGRAMMABLE DIGITAL MODEM
M. Kappes *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 219-222 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

Information on programmable digital modems (PDM) is given in viewgraph form. Topics covered include data rate range and operational modes, test and demonstration equipment, program goals, modulation formats, and PDM design challenges.

Author

N92-22015*# Motorola, Inc., Chandler, AZ.
ATDRSS 300 MB/S MODEM PROGRAM
Carl R. Ryan *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992

p 231-244 (For primary document see N92-22001 12-17)
(Contract NAS5-30095)
Avail: NTIS HC/MF A14 CSCL 17B

The 300 Mbps modem was developed for direct application to the next generation high data rate Time Division Multiple Access (TDMA) communication system. This modem utilizes continuous phase modulation combined with a restricted range Reed-Solomon Codec to achieve a bandwidth efficiency of 3 bits/sec/hz. The constant envelope amplitude signal allows one to operate the power amplifier in its saturation mode without significant spectral regrowth or bit error rate degradation. Author

N92-22016*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MODULATION AND CODING TECHNOLOGY FOR DEEP SPACE AND SATELLITE APPLICATIONS
J. H. Yuen and W. Rafferty *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 245-256 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

Modulation and coding research and development at the Jet Propulsion Laboratory (JPL) currently emphasize Deep Space Communications Systems and advanced near earth Commercial Satellite Communications Systems. The Deep Space Communication channel is extremely signal to noise ratio limited and has long transmission delay. The near earth satellite channel is bandwidth limited with fading and multipath. Recent code search efforts at JPL have found a long constraint, low rate convolutional code (15, 1/6) which, when concatenated with a ten bit Reed-Solomon (RS) code, provides a 2.1 dB gain over that of the Voyager spacecraft - the current standard. The new code is only 2 dB from the theoretical Shannon limit. A flight qualified version of the (15, 1/6) convolutional encoder was implemented on the Galileo Spacecraft to be launched later this year. An L-band mobile link, use of the Ka-band for personal communications, and the development of subsystem technology for the interconnection of satellite resources by using high rate optical inter-satellite links are noted. Author

N92-22017*# LinCom Corp., Los Angeles, CA.
DIGITAL SYNCHRONIZATION AND COMMUNICATION TECHNIQUES
William C. Lindsey *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 257-267 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

Information on digital synchronization and communication techniques is given in viewgraph form. Topics covered include phase shift keying, modems, characteristics of open loop digital synchronizers, an open loop phase and frequency estimator, and a digital receiver structure using an open loop estimator in a decision directed architecture. Author

N92-22018*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
BANDWIDTH EFFICIENT CODING FOR SATELLITE COMMUNICATIONS
Shu Lin, Daniel J. Costello, Jr. (Notre Dame Univ., IN.), Warner H. Miller, James C. Morakis, and William B. Poland, Jr. *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 269-292 (For primary document see N92-22001 12-17)
(Grants NAG5-931; NAG5-557)
Avail: NTIS HC/MF A14 CSCL 17B

An error control coding scheme was devised to achieve large coding gain and high reliability by using coded modulation with reduced decoding complexity. To achieve a 3 to 5 dB coding gain and moderate reliability, the decoding complexity is quite modest. In fact, to achieve a 3 dB coding gain, the decoding complexity is quite simple, no matter whether trellis coded modulation or block coded modulation is used. However, to achieve coding gains exceeding 5 dB, the decoding complexity increases drastically, and the implementation of the decoder becomes very expensive and unpractical. The use is proposed of coded modulation in conjunction with concatenated (or cascaded) coding. A good short bandwidth efficient modulation code is used as the inner code and relatively powerful Reed-Solomon code is used as the outer code. With properly chosen inner and outer codes, a concatenated coded modulation scheme not only can achieve large coding gains and high reliability with good bandwidth efficiency but also can be practically implemented. This combination of coded modulation and concatenated coding really offers a way of achieving the best of three worlds, reliability and coding gain, bandwidth efficiency, and decoding complexity. Author

N92-22019*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FUTURE COMMUNICATIONS SATELLITE APPLICATIONS
James W. Bagwell *In its* Advanced Modulation and Coding Technology Conference Feb. 1992 p 295-306 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

The point of view of the research is made through the use of viewgraphs. It is suggested that future communications satellite applications will be made through switched point to point narrowband communications. Some characteristics of which are as follows: small/low cost terminals; single hop communications; voice compatible; full mesh networking; ISDN compatible; and possible limited use of full motion video. Some target applications are as follows: voice/data networks between plants and offices in a corporation; data base networking for commercial and science users; and cellular radio internodal voice/data networking. Author

N92-22020*# National Aeronautics and Space Administration, Washington, DC.
ADVANCED TRACKING AND DATA RELAY SATELLITE SYSTEM
Daniel Stern *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 307-313 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

The purpose of this communication satellite system are as follows: to provide NASA needs for satellite tracking and communications through the year 2012; to maintain and augment the current TDRS system when available satellite resources are expended in the latter part of the decade; to provide the necessary ground upgrade to support the augmented services; and to introduce new technology to reduce the system life cycle cost. It is concluded that no ATDRS spacecraft requirement for new modulation techniques, that data rate of 650 MBps is required, and that Space Station Freedom requirement is for 650 MBps data some time after the year 2000. Author

N92-22021*# International Telecommunications Satellite Organization, Washington, DC.
INTERNATIONAL COMMUNICATIONS SATELLITE SYSTEMS
William W. Wu *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 315-326 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

Ten satellite systems for international communication are briefly described. Modulation and coding schemes on some of these systems are highlighted. Author

N92-22022*# Hughes Communications, Inc., El Segundo, CA.
MODULATION AND CODING USED BY A MAJOR SATELLITE COMMUNICATIONS COMPANY
K. H. Renshaw *In* NASA. Lewis Research Center, Advanced Modulation and Coding Technology Conference Feb. 1992 p 327-330 (For primary document see N92-22001 12-17)
Avail: NTIS HC/MF A14 CSCL 17B

Hughes Communications Inc., is a major satellite communications company providing or planning to provide the full spectrum of services available on satellites. All of the current

services use conventional modulation and coding techniques that were well known a decade or longer ago. However, the future mobile satellite service will use significantly more advanced techniques. JPL, under NASA sponsorship, has pioneered many of the techniques that will be used. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N92-21161*# Texas Univ., Austin. Dept. of Aerospace and Engineering Mechanics.

SELF-UNLOADING, UNMANNED, REUSABLE LUNAR LANDER PROJECT Final Report

Kevin Cowan, Ron Lewis, Philip Mislinski, Donna Rivers, Solar Smith, Clifford Vasicek, and Matt Verona 5 May 1991 94 p
(Contract NASw-4435)
(NASA-CR-190005; NAS 1.26:190005) Avail: NTIS HC/MF A05 CSCL 22B

A payload delivery system will be required to support the buildup and operation of a manned lunar base. In response, a self-unloading, unmanned, reusable lunar lander was conceptually designed. The lander will deliver a 7000 kg payload, with the same dimensions as a space station logistics module, from low lunar orbit to any location on the surface of the moon. The technical aspects of the design is introduced as well as the management structure and project cost. Author

N92-21242*# Old Dominion Univ., Norfolk, VA. Advanced Design Program.

CONCEPTUAL DESIGN OF AN ORBITAL DEBRIS COLLECTOR

Peter ODonoghue, ed., Brian Brenton, Ernest Chambers, Thomas Schwind, Christopher Swanhart, and Thomas Williams 25 Nov. 1991 100 p
(Contract NASw-4435)
(NASA-CR-189989; NAS 1.26:189989) Avail: NTIS HC/MF A05 CSCL 22B

The current Lower Earth Orbit (LEO) environment has become overly crowded with space debris. An evaluation of types of debris is presented in order to determine which debris poses the greatest threat to operation in space, and would therefore provide a feasible target for removal. A target meeting these functional requirements was found in the Cosmos C-1B Rocket Body. These launchers are spent space transporters which constitute a very grave risk of collision and fragmentation in LEO. The motion and physical characteristics of these rocket bodies have determined the most feasible method of removal. The proposed Orbital Debris Collector (ODC) device is designed to attach to the Orbital Maneuvering Vehicle (OMV), which provides all propulsion, tracking, and power systems. The OMV/ODC combination, the Rocket Body Retrieval Vehicle (RBRV), will match orbits with the rocket body, use a spin table to match the rotational motion of the debris, capture it, despin it, and remove it from orbit by allowing it to fall into the Earth's atmosphere. A disposal analysis is presented to show how the debris will be deorbited into the Earth's atmosphere. The conceptual means of operation of a sample mission is described. Author

N92-21244*# Maryland Univ., College Park. Dept. of Aerospace Engineering.

TAURUS LIGHTWEIGHT MANNED SPACECRAFT EARTH ORBITING VEHICLE

Kevin A. Chase, Eric J. Vandersall, Jennifer Plotkin, Jeffrey J. Travisano, Dennis Loveless, Michael Kaczmarek, Anthony G. White, Andy Est, Gregory Bulla, and Chris Henry et al 25 Nov. 1991 331 p
(Contract NASw-4435)
(NASA-CR-190000; NAS 1.26:190000) Avail: NTIS HC/MF A15 CSCL 22B

The Taurus Lightweight Manned Spacecraft (LMS) was developed by students of the University of Maryland's Aerospace Engineering course in Space Vehicle Design. That course required students to design an Alternative Manned Spacecraft (AMS) to augment or replace the Space Transportation System and meet the following design requirements: (1) launch on the Taurus Booster being developed by Orbital Sciences Corporation; (2) 99.9 percent assured crew survival rate; (3) technology cutoff data of 1 Jan. 1991; (4) compatibility with current space administration infrastructure; and (5) first flight by May 1995. The Taurus LMS design meets the above requirements and represents an initial step towards larger and more complex spacecraft. The Taurus LMS has a very limited application when compared to the Space Shuttle, but it demonstrates that the U.S. can have a safe, reliable, and low cost space system. The Taurus LMS is a short mission duration spacecraft designed to place one man into low earth orbit (LEO). The driving factor for this design was the low payload carrying capabilities of the Taurus Booster--1300 kg to a 300 km orbit. The Taurus LMS design is divided into six major design sections. The human factors system deals with the problems of life support and spacecraft cooling. The propulsion section contains the abort system, the Orbital Maneuvering System (OMS), the Reaction Control System (RCS), and power generation. The thermal protection systems and spacecraft structure are contained in the structures section. The avionics section includes navigation, attitude determination, data processing, communication systems, and sensors. The mission analysis section was responsible for ground processing and spacecraft astrodynamics. The systems integration section pulled the above sections together into one spacecraft and addressed costing and reliability. Author

N92-21999* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

ASSURED CREW RETURN VEHICLE Patent

Christopher J. Cerimele, inventor (to NASA), Robert C. Ried, inventor (to NASA), Wayne L. Peterson, inventor (to NASA), George A. Zupp, Jr., inventor (to NASA), Michael J. Stagnaro, inventor (to NASA), and Brian P. Ross, inventor (to NASA) 12 Nov. 1991 54 p Filed 28 Dec. 1989
(NASA-Case-MSC-21536-1; NAS 1.71:MSC-21536-1; US-Patent-5,064,151; US-Patent-Appl-SN-458476; US-Patent-Class-244-160; US-Patent-Class-244-163; US-Patent-Class-244-162; Int-Patent-Class-B64G-1/62) US Patent and Trademark Office CSCL 22B

A return vehicle is disclosed for use in returning a crew to Earth from low earth orbit in a safe and relatively cost effective manner. The return vehicle comprises a cylindrically-shaped crew compartment attached to the large diameter of a conical heat shield having a spherically rounded nose. On-board inertial navigation and cold gas control systems are used together with a de-orbit propulsion system to effect a landing near a preferred site on the surface of the Earth. State vectors and attitude data are loaded from the attached orbiting craft just prior to separation of the return vehicle.

Official Gazette of the U.S. Patent and Trademark Office

N92-21267*# City Univ. of New York, Bronx. Dept. of Physics and Astronomy.

INVESTIGATION OF TECHNIQUES FOR SIMULATING COMMUNICATIONS AND TRACKING SUBSYSTEMS ON SPACE STATION FREEDOM Final Report

Louis A. DeAcetis *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 8 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

N92-21306*# California Univ., San Diego, La Jolla. Dept. of AMES.
NONDESTRUCTIVE STRUCTURAL DAMAGE DETECTION IN FLEXIBLE SPACE STRUCTURES USING VIBRATION CHARACTERIZATION Final Report
James M. Ricles *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 17 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 22B

N92-21308*# Houston Univ., TX. Dept. of Mathematics.
THE DEVELOPMENT OF HIGH ORDER NUMERICAL TECHNIQUES FOR REENTRY SIMULATION OF HYPERSONIC SPACECRAFT Final Report
Richard Sanders *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 16 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 22B

N92-22093# National Space Development Agency, Tokyo (Japan). Engineering Test Satellite Group.
DEVELOPMENT TEST RESULTS OF ETS-6 STRUCTURAL DEVELOPMENT MODEL
Akio Tsujihata *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 91-122 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

N92-22094# National Space Development Agency, Tokyo (Japan). Tsukuba Space Center.
RESEARCH AND DEVELOPMENT ON LARGE DEPLOYABLE ANTENNA
Yasumasa Hisada *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 123-157 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N92-21176*# Tuskegee Inst., AL. Dept. of Mechanical Engineering.
MODELING OF LIFE LIMITING PHENOMENA IN THE DISCHARGE CHAMBER OF AN ELECTRON BOMBARDMENT ION THRUSTER Final Report
Arvind K. Handoo and Pradosh K. Ray 1991 98 p
(Grant NAG8-020)
(NASA-CR-190048; NAS 1.26:190048) Avail: NTIS HC/MF A05 CSCL 21C

An experimental facility to study the low energy sputtering of metal surfaces with ions produced by an ion gun is described. The energy of the ions ranged from 10 to 500 eV. Cesium ions with energies from 100 to 500 eV were used initially to characterize the operation of the ion gun. Next, argon and xenon ions were used to measure the sputtering yields of cobalt (Co), Cadmium (Cd), and Chromium (Cr) at an operating temperature of 2x10(exp -5) Torr. The ion current ranged from 0.0135 micro-A at 500 eV. The targets were electroplated on a copper substrate. The surface density of the electroplated material was approx. 50 micro-g/sq cm. The sputtered atoms were collected on an aluminum foil surrounding the target. Radioactive tracers were used to measure the sputtering yields. The sputtering yields of Cr were found to be much higher than those of Co and Cd. The yields of Co and Cd were comparable, with Co providing the higher yields. Co and Cd targets were observed to sputter at energies as low as 10 eV for both argon and xenon ions. The Cr yields could not be measured below 20 eV for argon ions and 15 eV for xenon ions. On a linear scale the yield energy curves near the threshold energies exhibit a concave nature. Author

N92-21187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FUELS AND MATERIALS DEVELOPMENT FOR SPACE NUCLEAR PROPULSION
S. K. Bhattacharyya, R. B. Matthews (Los Alamos National Lab., NM.), and R. H. Titran 1992 12 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contract W-31-109-eng-38)
(NASA-TM-107806; NAS 1.15:107806; DE92-007378; ANL/CP-75370; CONF-920104-31) Avail: NTIS HC/MF A03 CSCL 21F

Nuclear propulsion has been identified as an enabling technology in meeting the mission of the Space Exploration Initiative (SEI). Both Nuclear Thermal Propulsion (NTP) and Nuclear Electric Propulsion (NEP) have roles to play in the initiative. Of the numerous specific development items that need to be undertaken for these technologies, nuclear fuels and materials are considered by experts as the most challenging and therefore require early attention. One of the six panels organized by the NASA/DOE/DoD Steering Committee to help plan the nuclear propulsion development tasks was dedicated to nuclear fuels, materials and related technologies. Considering only the solid core concepts presented in the 1990 workshops on NTP and NEP, the panel concluded that there were classes of fuels and materials that had the potential to meet the demanding temperature and lifetime requirements for SEI in the timeframe of interest. Plans for the development of fuels and materials were prepared. A full development plan is going to involve the construction of several major new facilities and the modification of many existing ones. For the fuels, areas of commonality have been explored to allow for effective early activity while the downselection process to focus the development takes place. For materials, the lack of definition of candidate selection by the concept proposers makes this somewhat more difficult. Careful coordination of the work will be essential to keep the development and characterization of fuels and materials on schedule and costs within bounds. DOE

N92-21213*# Alabama Univ., Huntsville.
INTERNAL BALLISTICS MODEL UPDATE FOR ASRM DOME Final Technical Report, 31 Aug. 1990 - 20 Feb. 1991
Mark H. Bowden and Billy Z. Jenkins 20 Feb. 1991 43 p
(Contract NAS8-36955)
(NASA-CR-184295; NAS 1.26:184295; UAH-5-32498) Avail: NTIS HC/MF A03 CSCL 21H

A previous report (no. 5-32279, contract NAS8-36955, DO 51) describes the measures taken to adapt the NASA Complex Burning Region Model and code so that is was applicable to the Advanced Solid Rocket Motor as envisioned at that time. The code so modified was called the CBRM-A. CBRM-A could calculate the port volume and burning area for the star, transition, and cylindrically perforated regions of the motor. Described here is a subsequent effort to add computation of port volume and burning area for the Advanced Solid Rocket Motor head dome. Sample output, input, and overview of the models are included. The software was configured in two forms - a stand alone head dome code and a code integrating the head dome solution with the CBRM-A. Author

N92-21216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EXPERIMENTS WITH PHASE CHANGE THERMAL ENERGY STORAGE CANISTERS FOR SPACE STATION FREEDOM
Thomas W. Kerslake 1991 17 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 4-9 Aug. 1991; cosponsored by ANS, SAE, ACS, AIAA, ASME, IEEE, and AIChE
(NASA-TM-104427; E-6102; NAS 1.15:104427) Avail: NTIS HC/MF A03 CSCL 10B

The solar dynamic power module proposed for the Space Station Freedom (SSF) uses the heat of fusion of a phase change material (PCM) to efficiently store thermal energy for use during eclipse periods. The PCM, a LiF-20CaF2 salt, is contained in annular, metal canisters located in a heat receiver at the focus of a solar concentrator. PCM canister ground-based experiments and analytical heat transfer studies are discussed. The hardware, test procedures, and test results from these experiments are discussed. After more than 900 simulated SSF orbital cycles, no canister cracks or leaks were observed and all data were successfully collected. The effect of 1-g test orientation on canister wall temperatures was generally small while void position was strongly dependent on test orientation and canister cooling. In one test orientation, alternating wall temperature data were measured that supports an earlier theory of oscillating vortex flow in the PCM melt. Analytical canister wall temperatures compared very favorably with experimental temperature data. This illustrates that ground-based canister thermal performance can be predicted well by analyses that employ straight-forward, engineering models of void behavior and liquid PCM free convection. Because of the accuracy of analytical models and the relative insensitivity of 1-g performance to test orientation, canister performance in micro-g should be predictable with a high degree of confidence by removing gravity effects from the analytical modeling. Author

N92-21222# Phillips Lab., Edwards AFB, CA.
ESTABLISHMENT OF MPD PERFORMANCE Final Report, Sep. 1982 - Aug. 1991
Salvador Castillo Dec. 1991 135 p
(AF Proj. 5730)
(AD-A244508; PL-TR-91-3086) Avail: NTIS HC/MF A07 CSCL 21/3

The Phillips Laboratory's Electric Propulsion Laboratory has conducted a preliminary experiment in the measurement of magnetoplasmadynamic performance for a matrix of various electrode lengths. This data was taken in a single shot pulsed mode which was quasi-steady state with regard to electrical properties. As part of the project, a total impulse stand was built which allowed the calculation of thrust, specific impulse, and thruster efficiency. Limitations in experimental equipment prevented the gathering of accurate data. The data has given general trends in MPD performance and has given a better understanding of MPD test facility requirements. The project will be absorbed into a larger, general plasma thruster development project. The knowledge gained from this project will be used to upgrade the pulsed MPD facility to gather accurate MPD thruster performance data. GRA

N92-21282# Pacific Northwest Lab., Richland, WA.
RELIABILITY COMPARISON OF VARIOUS NUCLEAR PROPULSION CONFIGURATIONS FOR MARS MISSION
D. R. Segna, J. E. Dagle, and W. F. Lyon, III (Westinghouse Hanford Co., Richland, WA.) Jan. 1992 8 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contract DE-AC06-76RL-01830)
(DE92-006728; PNL-SA-20210; CONF-920104-28) Avail: NTIS HC/MF A02

Currently, trade-offs are being made among the various propulsion systems being considered for the Space Exploration Initiative (SEI) missions. It is necessary to investigate the reliability aspects as well as the efficiency, mass savings, and experience characteristics of the various configurations. Reliability is a very important factor for the SEI missions because of the long duration and because problems will be fixed onboard. The propulsion options that were reviewed consist of nuclear thermal propulsion (NTP), nuclear electric propulsion (NEP) and various configurations of each system. There were four configurations developed for comparison with the NTP as baselined in the synthesis (1991): (1) NEP, (2) hybrid NEP/NTP, (3) hybrid with power beaming, and (4) NTP upper stage on the heavy lift launch vehicle (HLLV). The comparisons were based more or less on a qualitative review of complexity, stress levels and operations for each of the four configurations. Each configuration included a pressurized NEP and an NTP ascent stage propulsion system for the Mars mission. DOE

N92-21494*# Alabama Univ., Huntsville. Center for Applied Optics.
MACH 6 ELECTROFORMED NICKEL NOZZLE REFURBISHMENT: FNAS INVESTIGATION OF ULTRA-SMOOTH SURFACES Final Report, Aug. - Nov. 1991
Robert Rood, Charles Griffith (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.), Darell Engelhaupt, and John Cernosek 30 Jan. 1992 59 p
(Contracts NAS8-38609; NAS8-36955)
(NASA-CR-184299; NAS 1.26:184299; UAH-5-32762) Avail: NTIS HC/MF A04 CSCL 21H

The task objective has been to apply a coating of nickel-phosphorous alloy to a laminar flow wind tunnel nozzle by catalytic deposition and then polish and inspect the inside surface using optical device processes. The surface of the nozzle was coated with a nickel-phosphorous alloy of sufficient hardness and corrosion resistance to improve the durability. Due to plating defects that were clearly process related and not inherent, the final polished part was less than the desired quality. Surface finishing processes and lapping media were identified which produced a submicron surface finish on the interior plated surface. Defects apparently manifested by the first plating attempt were repaired using a small brush plating process demonstrating that individual small defects can be repaired. Measurement and analysis by profilometry demonstrated that quantitative control of the surface can be achieved. Author

N92-21517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ROCKET-BASED COMBINED-CYCLE (RBCC) PROPULSION TECHNOLOGY WORKSHOP. TUTORIAL SESSION
1992 259 p Workshop held in Huntsville, AL, 23-27 Mar. 1992; sponsored by NASA, Washington
(NASA-CP-10090; E-6929; NAS 1.55:10090) Avail: NTIS HC/MF A12 CSCL 21H

The goal of this workshop was to illuminate the nation's space transportation and propulsion engineering community on the potential of hypersonic combined cycle (airbreathing/rocket) propulsion systems for future space transportation applications. Four general topics were examined: (1) selections from the expansive advanced propulsion archival resource; (2) related propulsion systems technical backgrounds; (3) RBCC engine multimode operations related subsystem background; and (4) focused review of propulsion aspects of current related programs. For individual titles, see N92-21518 through N92-21538.

N92-21518*# Lindley (Charles A.), Tarzana, CA.
EARLY AEROSPACEPLANE PROPULSION RESEARCH: MARQUARDT CORPORATION: CA 1956-1963
Charles A. Lindley *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

A brief summary is presented of the very early days of aerospaceplane propulsion and concept research, from a viewpoint based in the Astro Division of Marquardt Aircraft Co. in the years listed, with some view into later times that were on Bill Escher's watch and others. Other groups who were pursuing the same

goals by various routes are discussed by some following speakers. The chief purpose is to bring out background information that may be of value to members of the workshop and future workers in the field. The state of engine and airframe technology at those times must be understood to make sense of the effort. Operational kerosene fueled ramjets were routinely flying Mach 2 to 3 in the Bomarc and Talos interceptors. One Marquardt ramjet had accelerated a Lockheed X-7 test vehicle to about Mach 4.7 in an all-out test, holding it at nearly 1 'G' until the fuel ran out. Development of further research at Marquardt is outlined.

Author

N92-21519*# General Applied Science Labs., Inc., Ronkonkoma, NY.

PIONEERING SCRAMJET DEVELOPMENTS BY ANTONIO FERRI **c07**

John I. Erdos and Louis M. Nucci *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 10 p (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21E

The concept is summarized of a diffusive burning supersonic combustion ramjet engine (scramjet) envisioned by Antonio Ferri and some of the salient technologies are highlighted as developed by General Applied Science Labs, PIBAL, and NYU, under his direction. Author

N92-21520*# Wright Research Development Center, Wright-Patterson AFB, OH.

ADVANCED RAMJET CONCEPTS PROGRAM **c07**

J. L. Leingang *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21E

Uniquely advantageous features, on both the performance and weight sides of the ledger, can be achieved through synergistic design integration of airbreathing and rocket technologies in the development of advanced orbital space transport propulsion systems of the combined cycle type. In the context of well understood advanced airbreathing and liquid rocket propulsion principles and practices, this precept of synergism is advanced mainly through six rather specific examples. These range from the detailed component level to the overall vehicle system level as follows: using jet compression; achieving a high area ratio rocket nozzle; ameliorating gas generator cycle rocket system deficiencies; using the in-duct special rocket thrust chamber assembly as the principal scramjet fuel injection operation; using the unstowed, covered fan as a duct closure for effecting high area ratio rocket mode operation; and creating a unique airbreathing rocket system via the onboard, cryogenic hydrogen induced air liquefaction process. Author

N92-21521*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

THE NASA HYPERSONIC RESEARCH ENGINE PROGRAM **c07**

Kennedy F. Rubert and Henry J. Lopez (Allied-Signal Aerospace Co., Torrance, CA.) *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21E

An overview is provided of the NASA Hypersonic Research Engine Program. The engine concept is described which was evolved, and the accomplishments of the program are summarized. The program was undertaken as an in-depth program of hypersonic airbreathing propulsion research to provide essential inputs to future prototype engine development and decision making. An airbreathing liquid hydrogen fueled research oriented scramjet was to be developed to certain performance goals. The work was many faceted, required aerodynamic design evaluation, structures development, and development of flight systems such as the fuel and control system, but the main objective was the study of the internal aerothermodynamics of the propulsion system. Author

N92-21522*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

HYPERSONIC AIRBREATHING PROPULSION/AIRFRAME INTEGRATION **c07**

John P. Weidner *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Turorial Session 1992 6 p (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21E

Recent interest in airbreathing hypersonic flight has centered around the need to develop advanced space launch systems which can reduce the cost of inserting payloads in orbit and make space more accessible. An effect of the thermal environment is to require the vehicle to operate at high altitudes, in very thin air, to maintain aircraft structural load limits. The high altitudes at which the hypersonic vehicle must operate give rise to the concept of an airframe integrated propulsion system to provide a much larger inlet and nozzle to process the required volume of air at low density, atmospheric conditions. In the integrated system, the forward portion of the vehicle compresses the air flow and serves as the external portion of the inlet; the aftbody completes the expansion process for the nozzle. In addition, the engine, which is contained between the body and the forebody shock wave, lends itself to a modular integration of a number of separate engines. In this manner, a relatively small engine can be defined to allow engine development in existing ground facilities. Author

N92-21523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

AIRBREATHING COMBINED CYCLE ENGINE SYSTEMS **c07**

John Rohde *In its* Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21E

The Air Force and NASA share a common interest in developing advanced propulsion systems for commercial and military aerospace vehicles which require efficient acceleration and cruise operation in the Mach 4 to 6 flight regime. The principle engine of interest is the turboramjet; however, other combined cycles such as the turboscramjet, air turborocket, supercharged ejector ramjet, ejector ramjet, and air liquefaction based propulsion are also of interest. Over the past months careful planning and program implementation have resulted in a number of development efforts that will lead to a broad technology base for those combined cycle propulsion systems. Individual development programs are underway in thermal management, controls materials, endothermic hydrocarbon fuels, air intake systems, nozzle exhaust systems, gas turbines and ramjet ramburners. Author

N92-21524*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.

AIR AUGMENTED CONVENTIONAL ROCKET ENGINES

Shahram Fahahngi *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Turorial Session 1992 p 7 (For primary document see N92-21517 12-20)

Avail: NTIS HC/MF A12 CSCL 21H

An analytical study was conducted to assess and estimate the level of effectiveness of an ejector/rocket or rocket engine nozzle after-burning concept for enhancement of a conventional rocket engine. Performance enhancement and thrust augmentation of an ejector/rocket system were evaluated for a National (or Advanced) Launch System (LNS or ALS) type engine, namely the Space Transportation Main Engine (STME), and its effects on the overall vehicle/propulsion system as payload weight, gross lift-off weight, and propellant weight. The focus was on using a fixed geometry ejector and utilizing the otherwise wasted exhaust excess fuel of rocket engines and burning it with injested atmospheric air to

produce additional thrust. Limited analyses were also performed to determine the effect of burning additional injected fuel with the secondary air on thrust augmentation. Author

N92-21525*# Marquardt Corp., Van Nuys, CA.
LIQUID AIR CYCLE ENGINES
Jerry Rosevear *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 9 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

Given here is a definition of Liquid Air Cycle Engines (LACE) and existing relevant technologies. Heat exchanger design and fabrication techniques, the handling of liquid hydrogen to achieve the greatest heat sink capabilities, and air decontamination to prevent heat exchanger fouling are discussed. It was concluded that technology needs to be extended in the areas of design and fabrication of heat exchangers to improve reliability along with weight and volume reductions. Catalysts need to be improved so that conversion can be achieved with lower quantities and lower volumes. Packaging studies need to be investigated both analytically and experimentally. Recycling with slush hydrogen needs further evaluation with experimental testing. Author

N92-21526*# National Aeronautics and Space Administration, Washington, DC.
CRYOGENIC HYDROGEN-INDUCED AIR-LIQUEFACTION TECHNOLOGIES FOR COMBINED-CYCLE PROPULSION APPLICATIONS
William J. D. Escher *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 19 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

Given here is a technical assessment of the realization of cryogenic hydrogen induced air liquefaction technologies in a prospective onboard aerospace vehicle process setting. The technical findings related to the status of air liquefaction technologies are reviewed. Compact lightweight cryogenic heat exchangers, heat exchanger atmospheric constituent fouling alleviation measures, para/ortho-hydrogen shift-conversion catalysts, cryogenic air compressors and liquid air pumps, hydrogen recycling using slush hydrogen as a heat sink, liquid hydrogen/liquid air rocket-type combustion devices, and technically related engine concepts are discussed. Much of the LACE work is related to aerospaceplane propulsion concepts that were developed in the 1960's. Emphasis is placed on the Liquid Air Cycle Engine (LACE). Author

N92-21527*# Marquardt Corp., Van Nuys, CA.
SUPERCHARGED EJECTOR RAMJET **c07**
Jerry Rosevear *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Turorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

The Supercharged Ejector Ramjet (SERJ) engine is a highly flexible and promising composite propulsion system offering significant payoffs in high performance vehicle systems. Its basic subsystems such as fan, ejector, and ramjet have been experimentally demonstrated. These components have also been integrated into engine demonstrators and tested in Marquardt Cell 2 facilities. It is recommended that Marquardt's past SERJ related test data and studies be reviewed and updated by incorporating state-of-the art technologies. Author

N92-21528*# General Electric Co., Cincinnati, OH.
INLET TECHNOLOGY **c02**
Paul Kutschenreuter *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 6 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 01A

At hypersonic flight Mach numbers, particularly above Mo = 10, the inlet compression process is no longer adiabatic, real gas chemistry takes on extra importance, and the combined effects of entropy layer and viscous effects lead to highly nonuniform flow profile characteristics at the combustor entrance. Under such conditions, traditional inlet efficiency parameters can be unnecessarily cumbersome and/or lacking in the ability to appropriately characterize the inlet flow and to provide insight into propulsion system performance. Recent experience suggests that the use of inlet entropy increases inlet efficiency in hypersonic applications. Author

N92-21529*# Allied-Signal Aerospace Co., Torrance, CA.
H2-FUELED HIGH-BYPASS TURBOFAN **c07**
J. C. Riple *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 11 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

The study developed preliminary design concepts for the exploitation of the properties of LH2 in a turbofan engine intended for air transport use, and showed the benefits which accrue in reduction of aircraf direct operating cost. Design concepts for the engine fuel delivery and control system, including the engine high pressure fuel pump, were developed, and general concept feasibility was shown. For both the engine and the fuel delivery and control system, recommendations were made for the advanced development which is necessary to bring the technology to a state of readiness for design application. The study was of necessity abbreviated in nature: more intensive study of both the engine and fuel delivery and control system is recommended. K.S.

N92-21530*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
ANNULAR NOZZLE ENGINE TECHNOLOGY
Al Martinez *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

The topics covered include: (1) driver rocket subsystem; (2) annular nozzle engine technology; (3) expansion-deflection nozzle; (4) aerospike-nozzled engine background; (5) aerospike testing; (6) linear aerospike; and (7) the combined cycle engine. K.S.

N92-21531*# Marquardt Corp., Van Nuys, CA.
H2 FUELED FLIGHTWEIGHT RAMJET CONSTRUCTION AND TEST **c07**
Albert Malek *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 11 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

The ACES Program began the investigation of regeneratively cooled ramjet engines for propelling aircraft at Mach 6 to 8 flight regimes while collecting and processing air for later use as oxidizer in rocket propulsion into an orbit flight mode. The Marquardt Company had as its prime task the design and demonstration of a ramjet capable of steady state operating using hydrogen as the regenerative coolant and with fuel flow limited to a theta = 1. Marquardt progressed from shell type combustors to advanced tubular combustion chambers in direct connect test rigs. The first tests were made with water cooled center bodies and plug nozzles using a pebble bed air heater to simulate flight air temperature. Later tests were made on completely H2 cooled flight weight V/G assemblies direct connected to a SUE burner heater. Design studies were also conducted on integrated systems for take-off capability using offset turbojets connected to 2-D or axisymmetric inlets. An 18 inch hypersonic ramjet evaluation scale model was designed based on the hot test results using a fully V/G inlet and exit nozzle. This thruster would provide 25000 lbs. of thrust with an estimated weight of 250 lbs. A V/G inlet would also incorporate

an inlet seal for possible take-off thrust by rocket operation. Hypersonic ramjet construction features and chamber thrust development are discussed. K.S.

N92-21532*# Wright Research Development Center, Wright-Patterson AFB, OH.
SCRAMJET ANALYSIS, TESTING **c07**
J. L. Leingang and F. D. Stull *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

A survey of supersonic combustion ramjet (scramjet) engine development in the US covers development of this unique engine cycle from its inception in the early 1960's through the various programs currently being pursued and, in some instances, describing the future direction of the programs. These include developmental efforts supported by the US Navy, NASA, and US Air Force. Results of inlet, combustor, and nozzle component tests, free-jet engine tests, analytical techniques developed to analyze and predict component and engine performance, and flight-weight hardware development are presented. These results show that efficient scramjet propulsion is attainable in a variety of flight configurations with a variety of fuels. Since the scramjet is the most efficient engine cycle for hypersonic flight within the atmosphere, it should be given serious consideration in future propulsion schemes. Author

N92-21533*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
SYSTEM CONTROLS CHALLENGES OF HYPERSONIC COMBINED-CYCLE ENGINE POWERED VEHICLES **c07**
Russell H. Morrison and George D. Ianculescu *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

Hypersonic aircraft with air-breathing engines have been described as the most complex and challenging air/space vehicle designs ever attempted. This is particularly true for aircraft designed to accelerate to orbital velocities. The propulsion system for the National Aerospace Plane will be an active factor in maintaining the aircraft on course. Typically addressed are the difficulties with the aerodynamic vehicle design and development, materials limitations and propulsion performance. The propulsion control system requires equal materials limitations and propulsion performance. The propulsion control system requires equal concern. Far more important than merely a subset of propulsion performance, the propulsion control system resides at the crossroads of trajectory optimization, engine static performance, and vehicle-engine configuration optimization. To date, solutions at these crossroads are multidisciplinary and generally lag behind the broader performance issues. Just how daunting these demands will be is suggested. A somewhat simplified treatment of the behavioral characteristics of hypersonic aircraft and the issues associated with their air-breathing propulsion control system design are presented. K.S.

N92-21534*# National Aero-Space Plane Joint Program Office, Wright-Patterson AFB, OH.
NASP X-30 PROPULSION TECHNOLOGY STATUS **c07**
William E. Powell *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

The performance goals of the NASP program require an aero-propulsion system with a high effective specific impulse. In order to achieve these goals, the high potential performance of air-breathing engines must be achieved over a very wide Mach number operating range. This, in turn, demands high component performance and involves many important technical issues which must be resolved. Scramjet Propulsion Technology is divided into five major areas: (1) inlets, (2) combustors, (3) nozzles, (4) component integration, and (5) test facilities. A status report covering the five areas is presented. D.R.D.

N92-21535*# National Aeronautics and Space Administration, Washington, DC.
NASA'S HYPERSONIC PROPULSION PROGRAM: HISTORY AND DIRECTION **c07**
Steve Wander *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 15 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21E

Research into hypersonic propulsion; i.e., supersonic combustion, was seriously initiated at the Langley Research Center in the 1960's with the Hypersonic Research Engine (HRE) project. This project was designed to demonstrate supersonic combustion within the context of an engine module consisting of an inlet, combustor, and nozzle. In addition, the HRE utilized both subsonic and supersonic combustion (dual-mode) to demonstrate smooth operation over a Mach 4 to 7 speed range. The propulsion program thus concentrated on fundamental supersonic combustion studies and free jet propulsion tests for the three dimensional fixed geometry engine design to demonstrate inlet and combustor integration and installed performance potential. The developmental history of the program is presented. Additionally, the HRE program's effect on the current state of hypersonic propulsion is discussed. D.R.D.

N92-21536*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
BETA 2: A NEAR TERM, FULLY REUSABLE, HORIZONTAL TAKEOFF AND LANDING TWO-STAGE-TO-ORBIT LAUNCH VEHICLE CONCEPT
Leo A. Burkardt *In its* Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 7 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

A recent study has confirmed the feasibility of a near term, fully reusable, horizontal takeoff and landing two-stage-to-orbit (TSTO) launch vehicle concept. The vehicle stages at Mach 6.5. The first stage is powered by a turboramjet propulsion system with the turbojets being fueled by JP and the ramjet by LH2. The second stage is powered by a space shuttle main engine (SSME) rocket engine. For about the same gross weight as growth versions of the 747, the vehicle can place 10,000 lbm. in low polar orbit or 16,000 lbm. to Space Station Freedom. D.R.D.

N92-21537*# Lindley (Charles A.), Tarzana, CA.
INTERNATIONAL AEROSPACEPLANE EFFORTS
Charles A. Lindley *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop, Tutorial Session 1992 8 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

Although the U.S. began the first reusable space booster effort in the late 1950's, it is no longer an exclusive field. All of the technologically advanced nations, and several groups of nations, have one or more reusable booster efforts in progress. A listing of the entries in the field is presented. The list is somewhat misleading, because it includes both fully reusable and partially reusable boosters, both manned and unmanned, and both flight test and operational proposals. Additionally, not all of the projects are funded, and only a few of the projects will survive. The most likely candidates are the following: France/ESA, Germany/ESA, Great Britain/ESA/(USSR), USSR(past), and Japan. A discussion of the preceding projects is provided. Author

N92-21538*# Astronautics Corp. of America, Madison, WI. Technology Center.
A REVIEW OF FINDINGS OF A STUDY OF ROCKET BASED COMBINED CYCLE ENGINES APPLIED TO EXTENSIVELY AXISYMMETRIC SINGLE STAGE TO ORBIT VEHICLES

Richard W. Foster *In* NASA. Lewis Research Center, Rocket-Based Combined-Cycle (RBCC) Propulsion Technology Workshop. Tutorial Session 1992 61 p (For primary document see N92-21517 12-20)
Avail: NTIS HC/MF A12 CSCL 21H

Extensively axisymmetric and non-axisymmetric Single Stage To Orbit (SSTO) vehicles are considered. The information is presented in viewgraph form and the following topics are presented: payload comparisons; payload as a percent of dry weight - a system hardware cost indicator; life cycle cost estimations; operations and support costs estimation; selected engine type; and rocket engine specific impulse calculation. D.R.D.

N92-21572# Pacific Northwest Lab., Richland, WA.
POWER OPTIONS FOR LUNAR EXPLORATION
J. A. Bamberger and K. L. Gaustad Jan. 1992 9 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contract DE-AC06-76RL-01830)
(DE92-006726; PNL-SA-19714; CONF-920104-26) Avail: NTIS HC/MF A02

This paper presents an overview of the types of power systems available for providing power on the moon. Lunar missions of exploration, in situ resource utilization, and colonization will be constrained by availability of adequate power. The length of the lunar night places severe limitations on solar power system designs, because a large portion of the system mass is devoted to energy storage. The selection of the ideal power source hardware will require compatibility with not only the lunar base power requirements and environment, but also with the conversion, storage, and transmission equipment. In addition, further analysis to determine the optimum operating parameters for a given power system should be conducted so that critical technologies can be identified in the early stages of base development. This paper describes the various concepts proposed for providing power on the lunar surface and compare their ranges of applicability. The importance of a systems approach to the integration of these components will also be discussed. DOE

N92-21976*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NEUTRALIZER OPTIMIZATION
Michael J. Patterson and Kayhan Mohajeri (Purdue Univ., West Lafayette, IN.) Oct. 1991 20 p Presented at the 22nd International Electric Propulsion Conference, Viareggio, Italy, 14-17 Oct. 1991; sponsored in part by AIDAA, AIAA, DGLR, and JSASS
(NASA-TM-105578; E-6903; NAS 1.15:105578) Avail: NTIS HC/MF A03 CSCL 21H

The preliminary results of a test program to optimize a neutralizer design for 30 cm xenon ion thrusters are discussed. The impact of neutralizer geometry, neutralizer axial location, and local magnetic fields on neutralizer performance is discussed. The effect of neutralizer performance on overall thruster performance is quantified, for thruster operation in the 0.5-3.2 kW power range. Additionally, these data are compared to data published for other north-south stationkeeping (NSSK) and primary propulsion xenon ion thruster neutralizers. Author

N92-21278*# Florida Inst. of Tech., Melbourne. Dept. of Computer Science.
PLANNING AND RESOURCE MANAGEMENT IN AN INTELLIGENT AUTOMATED POWER MANAGEMENT SYSTEM Final Report
Robert A. Morris *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 16 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 10B

23 CHEMISTRY AND MATERIALS (GENERAL)

N92-21149# Notre Dame Univ., IN. Radiation Lab.
ROLE OF SUPPORT MATERIAL IN THE PHOTODEGRADATION OF COLORED ORGANIC COMPOUNDS
P. V. Kamat and K. Vinodgopal (Indiana Univ. Northwest, Gary.) 1992 4 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC02-76ER-00038)
(DE92-004313; DOE/ER-00038/3435; NDRL-3435; CONF-920444-7) Avail: NTIS HC/MF A01

Naturally abundant support materials such as silica, alumina, titania and clays provide ordered, two-dimensional environments for effecting and controlling photochemical processes of organic compounds more efficiently than can be attained in homogeneous solutions. Little effect has been made so far to study how the intrinsic properties of such support materials can influence the photochemical degradation of colored organic compounds. In the present study, we have employed 1,3-diphenylisobenzofuran (DPBF) as a model compound since it strongly absorbs in the visible and is photochemically reactive. In the absence oxygen the semiconductor supports TiO2 and ZnO catalyze the photodegradation by accepting electrons from excited DPBF. In oxygenated samples, the primary process of photodegradation involves reaction with singlet oxygen. Steady state photolysis and diffuse reflectance laser flash photolysis experiments which elucidate the mechanistic and kinetic aspects of DPBF photodegradation on Al2O3, TiO2 and ZnO surfaces will be described in this paper. DOE

N92-21175*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SLIDING DURABILITY OF TWO CARBIDE-OXIDE CANDIDATE HIGH TEMPERATURE FIBER SEAL MATERIALS IN AIR TO 900 C
Christopher DellaCorte and Bruce M. Steinetz 1992 15 p Proposed for presentation at the Ninth International Conference of Wear of Materials, San Francisco, CA, 13-17 Apr. 1993
(NASA-TM-105554; E-6877; NAS 1.15:105554) Avail: NTIS HC/MF A03 CSCL 07A

A test program to determine the friction and wear properties of two complex carbide oxide ceramic fibers for high temperature sliding seal applications is described. The fibers are based on Si, C, O, and Ti or Si, C, N, and O ceramic systems. Pin on disk tests using ceramic fiber covered pins and Inconel 718 disks, were conducted in air from 25 to 900 C to evaluate potential seal materials. This testing procedure was used in a previous study of oxide ceramic fibers which were found to exhibit wear behavior based predominantly on their mechanical properties. Like the oxide fibers tested previously, these carbide oxide ceramic fibers, show an increase in friction and wear with increased test temperature. At room temperature, the wear behavior seems to be based upon mechanical properties, namely tensile strength. At 500 and especially 900 C, the fibers wear by both mechanical fracture and by oxidative type wear. Based upon post test microscopic and x ray analyses, interaction between the fiber constituents and elements transferred from the counterface, namely Ni and Cr, may have occurred enhancing the tribochemical wear process. These results are interpreted. Author

N92-21548*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ION BEAM TREATMENT OF POTENTIAL SPACE MATERIALS AT THE NASA LEWIS RESEARCH CENTER
Michael Kussmaul (Sverdrup Technology, Inc., Brook Park, OH.), Michael J. Mirtich, and Arthur Curren 1992 17 p Presented at the Surface Modification of Metals by Ion Beams, Washington, DC, 15-19 Jul. 1991; sponsored by the Naval Research Lab.
(NASA-TM-105398; E-6794; NAS 1.15:105398) Avail: NTIS HC/MF A03 CSCL 07A

Ion source systems in different configurations, have been used to generate unique morphologies for several NASA space applications. The discharge chamber of a 30 cm ion source was successfully used to texture potential space radiator materials for the purpose of obtaining values of thermal emittance greater than 0.85 at 700 and 900 K. High absorptance surfaces were obtained using ion beam seed texturing, for space radiator materials that were flown on the Long Duration Exposure Facility (LDEF) for 5.8 years in space. An ion source discharge chamber was also used to develop electrode surfaces with suppressed secondary electron emission characteristics for use in collectors in microwave amplifier traveling wave tubes. This was accomplished by sputtering textured carbon onto copper as well as texturing copper using tantalum and molybdenum as sacrificial texture inducing seeding materials. In a third configuration, a dual ion beam system was used to generate high transmittance diamondlike carbon (DLC) films.

Author

N92-21721# Exfluor Research Corp., Austin, TX.
IMPROVED METHOD FOR SYNTHESIS OF DIFUNCTIONAL FLUOROALCOHOLS Final Report, Apr. 1989 - Jul. 1991
Timothy J. Juhlke, Thomas R. Bierschenk, Hajimu Kawa, and Richard J. Lagow 3 Jun. 1991 46 p
(Contract N60921-89-C-0042)
(AD-A245070; NAVSWC-TR-91-322) Avail: NTIS HC/MF A03 CSCL 07/3

A series of fluorinated diacids were prepared by the direct fluorination of hydrocarbon acid derivitives with fluorine gas. These diacids were then reduced to fluorinated alcohols with sodium borohydride. A miniplant capable of producing fluorinated diols at a rate of five pounds per day was constructed to demonstrate the technology. The resulting diols were obtained in much better yields than by conventional synthetic fluorocarbon chemistry. In addition, diols of perfluoropolyether acids were made that are not available using other synthetic methods. The compounds prepared for this contract were 2,2,3,3,4,4- hexafluoropentane-1,5-diol, 2,2,3,3,4,4,5,5- octofluorohexane-1,6-diol, 2,2,4,4,5,5,7,7-octofluoro-3,6-dioxaoctane- 1,8-diol, and 2,2,3,3,4,4,6,6,7,7,8,8,9,9,11,11,12,12,13,13,14,14, 16,16,17,17,18,18-octacosafluoro-5,10,15 trioxanonadecane-1,19-diol.

GRA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials*.

N92-21088# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.
FABRICATION AND CHARACTERIZATION OF A POLYETHYLENE/POLYETHYLENE COMPOSITE [MISE EN OEUVRE ET CARACTERISATION D'UN COMPOSITE POLYETHYLENE/POLYETHYLENE]
C. Marais Feb. 1990 74 p In FRENCH
(Contract DRET-89-34-001)
(ONERA-RT-4/3553-M; ETN-92-90944) Avail: NTIS HC/MF A04

The investigation performed on polythylene matrix composites is presented. The choice and the characteristics of the matrix are discussed. A method for manufacturing pre-impregnated polymers and a moulding technique for thermoplastic polymers are presented. The thermoplastic composite is studied and compared to other organic matrix composites. The first results of the experiments on the polymer's properties are presented. The polythylene/polythylene composite is a compact material, lighter than water and suitable for very low temperature applications.

ESA

N92-21089# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.
HIGH YIELD POLYETHYLENE FIBER COMPOSITE AND POLYETHYLENE MATRIX [COMPOSITES A FIBRES POLYETHYLENE HAUT-MODULE ET MATRICE POLYETHYLENE]
C. Marais Jul. 1991 34 p In FRENCH
(Contract DRET-89-34-001-BC-88)
(ONERA-RT-8/3553-M; ETN-92-90945) Avail: NTIS HC/MF A03

The thermomechanical properties of the polyethylene/polythylene composite material are characterized. The tensile properties were investigated at different directions relating to the fiber's axis. Bend tests were also performed. The results show that: the tensile properties depend on the fiber fabrication characteristics; for tests performed at usual temperatures (lower than 100 C) a decrease of the mechanical characteristics is observed; the tests demonstrated the very high thermomechanical strength of the composite for loads applied in the fiber's axis direction. The polyethylene/polyethylene composites are suitable for use at cryogenic temperatures and, because of low permittivity, suitable for use in the range of radar frequencies. This composite is a light and, chemically stable material.

ESA

N92-21154# Argonne National Lab., IL.
A FIRST LOOK AT EROSION OF CONTINUOUS-FIBER REINFORCED CERAMIC-MATRIX COMPOSITES
K. R. Karasek, S. T. Gonczy (Allied-Signal Corp., Des Plaines, IL.), J. B. Kupperman, E. J. Zamirowski, K. C. Goretta, and J. L. Routbort Dec. 1991 15 p Presented at the 16th Annual Conference on Composites, Materials, and Structures, Coca Beach, FL, 13-16 Jan. 1992
(Contract W-31-109-eng-38)
(DE92-006975; ANL/CP-74004; CONF-920144-2) Avail: NTIS HC/MF A03

We report the initial results of a study of solid particle erosion of Nicalon (tmk) SiC reinforced carbon-modified silica-glass composites. SiC abrasives with diameters between 42 to 390 microns were used with impact angles of 30 and 90 degs, and velocities ranged 30 to 80 m/s. Fibers were parallel to the surface in all cases. Woven-fiber composites exhibited the same erosive behavior as uniaxial composites. Interfacial chemistry was controlled, and the comparison between composites which exhibit 'low strength brittle' and 'high strength fibrous' fractures under flexure conditions showed no significant difference in erosion resistance. This result and SEM data indicate that most of the fracture occurs within the matrix and/or at the fiber-matrix interface. We have found in previous work that polymer-matrix composites (with fibers parallel to the surface) are more susceptible to erosion damage than the matrix polymer. This also appears to be the case for the ceramic composites.

DOE

N92-21174*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Composite Materials and Structures.
AN INFILTRATION/CURE MODEL FOR MANUFACTURE OF FABRIC COMPOSITES BY THE RESIN INFUSION PROCESS Interim Report, Aug. 1989 - Oct. 1991
Mark H. Weideman, Alfred C. Loos, H. Benson Dexter, and Gregory H. Hasko (Lockheed Engineering and Sciences Co., Hampton, VA.) Feb. 1992 205 p
(Grant NAG1-343)
(NASA-CR-190154; NAS 1.26:190154; CCMS-92-05; VPI-E-92-05) Avail: NTIS HC/MF A10 CSCL 11D

A 1-D infiltration/cure model was developed to simulate fabrication of advanced textile composites by the resin film infusion process. The simulation model relates the applied temperature and pressure processing cycles, along with the experimentally measured compaction and permeability characteristics of the fabric preforms, to the temperature distribution, the resin degree of cure and viscosity, and the infiltration flow front position as a function of time. The model also predicts the final panel thickness, fiber volume fraction, and resin mass for full saturation as a function of

compaction pressure. Composite panels were fabricated using the RTM (Resin Transfer Molding) film infusion technique from knitted, knitted/stitched, and 2-D woven carbon preforms and Hercules 3501-6 resin. Fabric composites were fabricated at different compaction pressures and temperature cycles to determine the effects of the processing on the properties. The composites were C-scanned and micrographed to determine the quality of each panel. Advanced cure cycles, developed from the RTM simulation model, were used to reduce the total cure cycle times by a factor of 3 and the total infiltration times by a factor of 2. Author

N92-21325# Lawrence Livermore National Lab., CA.
LAMINATED METAL MATRIX COMPOSITES OF ULTRA-HIGH CARBON STEEL-BRASS AND Al-Al/SiC: PROCESSING AND PROPERTIES
C. K. Syn, D. R. Lesuer, K. L. Cadwell, O. D. Sherby, and K. R. Brown Nov. 1991 16 p Presented at the Minerals, Metals, and Materials Society (TMS) Annual Meeting and Exhibition, San Diego, CA, 1-5 Mar. 1992
(Contract W-7405-eng-48)
(DE92-007362; UCRL-107581-Rev-1; CONF-920305-5-Rev-1)
Avail: NTIS HC/MF A03

We have fabricated laminated metal composites of: (1) ultrahigh carbon steel (1.8 percent C) and brass (70Cu-30Zn); and (2) aluminum 5182 and aluminum 6061 with 25 vol. percent SiCp. The laminates were prepared by hot pressing alternating layers of the component materials in an argon gas atmosphere. The steel was thermomechanically processed to produce a fine grained microstructure that exhibited superplasticity. The brass and aluminum materials were obtained from commercial sources and used in the as-received condition. Laminates with different numbers of layers and layer thickness were made. The compressive stress and strain rate were measured during hot pressing, and material flow behavior in the UHCS-brass laminate was found to be rate-controlled by the stronger component rather than by the softer one (brass). Material flow behavior was more complicated in the Al-laminate. Tensile and fracture behavior were determined by tensile tests and by chevron notched fracture toughness tests. Details of processing, microstructure, and initial results of mechanical property tests of these laminates are discussed.
DOE

N92-21332# Washington Univ., Seattle. Dept. of Materials Science and Engineering.
PROCESSING OF A MULLITE MATRIX, MOLYBDENUM DISILICIDE REINFORCED COMPOSITE M.S. Thesis
Richard Brynsvold 1991 112 p
(AD-A244985) Avail: NTIS HC/MF A06 CSCL 11/4

A mullite matrix reinforced with molybdenum disilicide particles was investigated as a potential high temperature composite material. Mullite is well known for its high temperature strength, creep resistance, corrosion resistance, and ability to withstand oxidizing environments. MoSi2 has the potential to be a good reinforcement because it forms a protective silica layer during oxidation, undergoes a brittle to ductile transformation at 900-1000 C which would increase high temperature composite toughness, and is thermodynamically stable with mullite. Samples containing 2.5 to 20 vol. percent MoSi2 were processed using both hot pressing and pressureless sintering techniques. Low temperature mechanical testing was performed both in the as sintered state and after oxidation at 1400 C for 96 hours. Densities of greater than 93 percent of the theoretical were attained for composites containing up to 20 vol. percent MoSi2 via pressureless sintering. K sub Ic and strength values of the as-sintered composite were up to two times that of monolithic mullite. After oxidation at 1400 C for 96 hours, strength improved by 1.5 times over the as-sintered strength, and fracture toughness improved by 2.5 times over the as-sintered toughness indicating that the composite is self-healing during oxidation. GRA

N92-21335# Argonne National Lab., IL.
DEVELOPMENT OF A BORON-COPPER NEUTRON ABSORBER COMPOSITE
T. C. Wiencek, H. R. Thresh, and J. R. Summers May 1991 34 p
(Contract W-31-109-eng-38)
(DE92-007416; ANL-91/44) Avail: NTIS HC/MF A03

This report describes the fabrication of a new boron-copper neutron absorbing material that was developed to meet the upgrading needs of the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory. To increase the intensity of the neutron beams from the IPNS, the target uranium was changed from depleted uranium to uranium enriched to 77.5 percent U-235. To keep the multiplication factor, k(sub eff) (the number of fissions in one generation/number of fissions in preceding generation) at a safe level, a new neutron absorber material was needed. The previous materials, boral and cadmium, could not meet the new requirements and a search of the literature showed that no currently available material was acceptable. With previous powder metallurgy used as a base, the composite was fabricated with 43 vol. percent B-10 (81 percent enriched B-10) and the balance copper and voids. The powder metallurgy technique was followed by hot-rolling the composite to a sheet. The material composed of boron particles dispersed in a pure copper matrix and clad with pure copper on both sides, exhibits the following properties: loadings up to 43 vol. percent boron, with the balance copper and voids. A loading of 0.5 x 10(exp 22) B-10 atoms/cm exp 2 in sections as thin as 0.067 in. (1.7 mm), with copper cladding as thin as 0.010 in. (0.25 mm). Formability to radii as small as 2.1 in. (53.3 mm). There is no observed reaction between boron and the copper matrix and cladding at temperatures up to 900 C for times as long as 7 hours, and it retains structural integrity at 900 C. DOE

N92-21343*# Georgia Inst. of Tech., Atlanta. School of Textile and Fiber Engineering.
NASA/USRA ADVANCED DESIGN PROGRAM ACTIVITY 1990/1991 Final Report
J. Lewis Dorrity and Jill B. Davis 1991 14 p
(Contract NASw-4435)
(NASA-CR-189998; NAS 1.26:189998) Avail: NTIS HC/MF A03 CSCL 11D

Four problems were defined which had aspects which would be reasonably assigned to an interdisciplinary design team. The design problems are: (1) design of a thermal shield for a lunar telescope (thermal protection for a lunar telescope); (2) selenotextile shielding structure (a structure to protect a lunar habitat from intense solar radiation of tubes of woven polytetrafluoroethylene coated fiberglass fabric); (3) pneumatically assisted elbow joint design for the NASA Zero-prebreathe suit (will allow astronauts to make the transition from a high pressure internal environment to a lower pressure suit without spending time in an air lock); and (4) electrochemical system to power assist an astronaut's finger joints (assist in the movement of an astronaut's distal and proximal interphalangeal finger joints).
Author

N92-21354# Southwest Research Inst., San Antonio, TX.
CHARACTERIZATION OF MECHANICAL DAMAGE MECHANISMS IN CERAMIC AND POLYMERIC MATRIX COMPOSITE MATERIALS Technical Report, Oct. 1990 - Oct. 1991
James Lankford, Jr. Nov. 1991 70 p
(Contract N00014-84-C-0213)
(AD-A245185) Avail: NTIS HC/MF A04 CSCL 11/4

The role of microplasticity in the compressive strength of strong ceramics is explored, emphasizing a representative oxide (Aluminum oxides) and non-oxide (Silicon carbides). Relevant results from studies of hardness, compressive behavior, and impact response are considered. The combined evidence indicates that microplasticity is a vital factor in the compressive failure of even these very hard materials under essentially all conditions (temperature, strain rate, confinement). It is shown that uniaxial compressive strengths achieved under perfect test conditions approach one-third of the hardness as a limit. Under most conditions, dislocation activity appears to be detrimental to compressive strength. Since only an extremely limited number of

slip systems is available for stresses below H/3, relaxation of intrinsic stress concentrators is ineffective; instead, the highly localized discrete slip bands themselves constitute intense grain boundary stress raisers, and thereby contribute significantly to prefailure compressive microfracture. Compressive failure of a 0 deg/90 deg glass fiber-reinforced amorphous thermoplastic is characterized. It is found that the critical event is the nucleation within 90 deg laminates of multiple shear crazes, which become shear microcracks, transition to axial cracks, and permit the specimen to fail by the flexure of 0 deg elements. Further, it is shown that the apparent kinetics of this process provide a rationale for the dramatic strain rate strengthening of these composites at high loading rate. GRA

N92-21389# Rockwell International Science Center, Anaheim, CA.
DETERMINATION OF INTERFACIAL PROPERTIES Final Report, 20 Feb. 1989 - 19 Aug. 1991
Michael R. James, Winfred L. Morris, and Mahyar S. Dadkhah Nov. 1991 41 p
(Contract N00014-89-C-0083)
(AD-A244600) Avail: NTIS HC/MF A03 CSCL 11/4

The primary objective of this program was to determine surface displacements in the resin matrix adjacent to a graphite fiber during applied fiber strain. These data are to be used to quantify the effect of interphases on fiber-matrix interfacial elastic properties. We successfully demonstrated the measurement of in-and out-of-plane displacement fields with sufficient spatial resolution to produce data for calculating the modulus and thickness of interphase layers in the epoxy within a few microns of the graphite fiber. The interphase layer was modified by using different surface treatments and coatings applied to the AS-4 fibers. The shear lag and finite element models used by NADC and ourselves to model the interphase are elastic. Our initial efforts at measuring surface displacement indicated that significant inelastic effects occurred during first load. At fiber strains above 0.4 percent, the inelastic effect could be shaken-out or relaxed by cyclic loads, after which the measured displacements were elastic and showed significant influence of the fiber surface treatment. However, substantial changes in the matrix could have occurred during the relaxation process, including microcracking of the interface. Measurement of the small displacements induced by the low fiber strains of less than 0.1 percent required the improved sensitivity obtained by a unique approach to recording SEM images of surface displacements resulting from load changes during image recording. GRA

N92-21416# Construcciones Aeronauticas S.A., Madrid (Spain). Project Div.
APPLICATION OF EDDY CURRENT TECHNIQUES TO GRAPHITE COMPOSITE MATERIALS
M. Alvaro and V. Cortes 1991 9 p
(ETN-92-90815) Avail: NTIS HC/MF A02

Eddy current methods have been extensively applied in metals. The common characteristic for these applications is the high electrical conductivity of materials tested, higher than 1 pct. IACS (titanium). With the increasing use of graphite composite materials it is necessary to develop NDT (NonDestructive Test) methods for defects detection and materials characterization. The development of eddy current technique in composites is different to the usual ones for metals due to two features of CFRP (Carbon Fiber Reinforced Plastics); low electrical conductivity and intrinsic heterogeneity. Therefore the theory and practice differ greatly from conventional techniques. Theoretical models are more complicated than analogous in metals. In the technical aspect, special characteristics are required for probes and equipments. Applications include defectology and materials characterization. Experience collected during work performed in this field indicates that by means of an eddy current test it is feasible to reveal defects as cracks, impact damages, broken fibers, etc., and also to obtain information about fiber resin volume fraction and layup variations. Eddy current methods provide a complement to ultrasonic methods in the NDT of CFRP. ESA

N92-21485# Los Alamos National Lab., NM.
SOME PHYSICAL PHENOMENA AND A PROPOSED EOS FOR COMPOSITE MATERIALS
R. C. Mjolsness Jan. 1992 51 p
(Contract W-7405-eng-36)
(DE92-008091; LA-12215-MS) Avail: NTIS HC/MF A04

Four physical mechanisms are studied which might account for the extensively distorted composite plate interfaces displayed by radiographs of fast shock tube experiments. Three mechanisms do not seem able to account for the extreme distortions, namely, large viscosity of the undecomposed VCE, blowoff of decomposed VCE, and pressure variations across the composite plate. The fourth mechanism, de-entrainment of the largest pellets in the decomposed VCE, may suffice, though an approximate analysis indicates that it is marginal. A generic technical problem, arising in numerous programs of active LANL interest, is solved here: the problem of obtaining an adequate, easily implementable equation of state (EOS) for composite materials. A robust, easily generalizable, model is presented in detail for the case of two condensed components and one gaseous component. The slightly nonroutine generalization to two gaseous components is also presented. DOE

N92-21605*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
AMSAHTS 1990: ADVANCES IN MATERIALS SCIENCE AND APPLICATIONS OF HIGH TEMPERATURE SUPERCONDUCTORS
Larry H. Bennett, ed., Yury Flom, ed., and Kishin Moorjani, ed. (Johns Hopkins Univ., Laurel, MD.) Jan. 1991 488 p Conference held in Greenbelt, MD, 2-6 Apr. 1990; sponsored in cooperation with NASA, NIST, JHU, and DARPA Previously announced as N90-27792
(NASA-CP-3100; Rept-90B00018; NAS 1.55:3100) Avail: NTIS HC/MF A21 CSCL 11D

This publication is comprised of abstracts for oral and poster presentations scheduled for AMSAHTS '90. The conference focused on understanding high temperature superconductivity with special emphasis on materials issues and applications. AMSAHTS 90, highlighted the state of the art in fundamental understanding of the nature of high-Tc superconductivity (HTSC) as well as the chemistry, structure, properties, processing and stability of HTSC oxides. As a special feature of the conference, space applications of HTSC were discussed by NASA and Navy specialists. For individual titles, see N92-21606 through N92-21678.

N92-21606*# National Tsing Hua Univ., Hsinchu (Taiwan). Dept. of Physics and Materials Center.
OXYGEN STABILIZATION INDUCED ENHANCEMENT IN SUPERCONDUCTING CHARACTERISTICS OF HIGH-Tc OXIDES **c76**
M. K. Wu, J. T. Chen, and C. Y. Huang (Lockheed Missiles and Space Co., Palo Alto, CA.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 3-17 Prepared in cooperation with Columbia Univ., New York, NY (For primary document see N92-21605 12-24)
(Grant NSC79-0208-M007-95)
Avail: NTIS HC/MF A21 CSCL 20L

In an attempt to enhance the electrical and mechanical properties of the high temperature superconducting oxides, high T(sub c) composites were prepared composed of the 123 compounds and AgO. The presence of extra oxygen due to the decomposition of AgO at high temperature is found to stabilize the superconducting 123 phase. Ag is found to serve as clean flux for grain growth and precipitates as pinning center. Consequently, almost two orders of magnitude enhancement in critical current densities were also observed in these composites. In addition, these composites also show much improvement in workability and shape formation. On the other hand, proper oxygen treatment of Y5Ba6Cu11Oy was found to possibly stabilize superconducting phase with T(sub c) near 250 K. I-V, ac susceptibility, and electrical resistivity measurements indicate the

existence of this ultra high T(sub c) phase in this compound. Detailed structure, microstructure, electrical, magnetic and thermal studies of the superconducting composites and the ultra high T(sub c) compound are presented and discussed. Author

N92-21607*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

MICROSTRUCTURE AND MAGNETIZATION OF Y-Ba-Cu-O PREPARED BY MELT QUENCHING, PARTIAL MELTING AND DOPING **c76**

Hamid Hojaji, Shouxiang Hu, Karen A. Michael, Aaron Barkatt, Arthur N. Thorpe (Howard Univ., Washington, DC.), and Sidney Alterescu *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 19-26 (For primary document see N92-21605 12-24)

(Grant NAG5-1017)

Avail: NTIS HC/MF A21 CSCL 20L

Y-Ba-Cu-O samples prepared by means of a variety of melt-based techniques exhibit high values for their magnetic properties compared with those of samples prepared by solid state sintering. These techniques include single-stage partial melting as well as melt quenching followed by a second heat treatment stage, and they have been applied to the stoichiometric 123 composition as well as to formulations containing excess yttrium or other dopants. The structure of these melt-based samples is highly aligned, and the magnetization readings exhibit large anisotropy. At 77 K and magnetic field intensities of about 2 kOe, diamagnetic susceptibilities as high as -14 x 10(exp -3) emu/g were obtained in the cases of melt-quenched samples and remanent magnetization values as high as 10 emu/g for samples prepared by partial melting. Author

N92-21608*# Texas Univ., El Paso. Dept. of Metallurgical and Materials Engineering.

EFFECT OF SHOCK PRESSURE ON THE STRUCTURE AND SUPERCONDUCTING PROPERTIES OF Y-Ba-Cu-O IN EXPLOSIVELY FABRICATED BULK METAL-MATRIX COMPOSITES **c76**

L. E. Murr, C. S. Niou, and M. Pradhan-Advani *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 27-36 (For primary document see N92-21605 12-24)

(Contracts NAS5-30504; N00014-88-C-0684)

Avail: NTIS HC/MF A21 CSCL 20L

While it is now well established that copper-oxide-based power, or virtually any other ceramic superconductor powder, can be consolidated and encapsulated within a metal matrix by explosive consolidation, the erratic superconductivity following fabrication has posed a major problem for bulk applications. The nature of this behavior was found to arise from microstructural damage created in the shock wave front, and the residual degradation in superconductivity was demonstrated to be directly related to the peak shock pressure. The explosively fabricated or shock loaded YBa2Cu3Ox examples exhibit drastically altered rho (or R) - T curves. The deterioration in superconductivity is even more noticeable in the measurement of ac magnetic susceptibility and flux exclusion or shielding fraction which is also reduced in proportion to increasing peak shock pressure. The high frequency surface resistance (in the GHz range) is also correspondingly compromised in explosively fabricated, bulk metal-matrix composites based on YBa2Cu3O7. Transmission electron microscopy (including lattice imaging techniques) is being applied in an effort to elucidate the fundamental (microstructural) nature of the shock-induced degradation of superconductivity and normal state conductivity. One focus of TEM observations has assumed that oxygen displaced from b-chains rather than oxygen-vacancy disorder in the basal plane of oxygen deficient YBa2Cu3Ox may be a prime mechanism. Shock-wave displaced oxygen may also be locked into new positions or interstitial clusters or chemically bound to displaced metal (possibly copper) atoms to form precipitates, or such displacements may cause the equivalent of local lattice cell changes as a result of stoichiometric changes. While the shock-induced suppression of T(sub c) is not desirable in the explosive fabrication of bulk metal-matrix superconductors, it may be turned into an advantage if the atomic-scale distortion can be understood and controlled as local flux pinning sites. Author

N92-21609*# Clemson Univ., SC. Dept. of Ceramic Engineering.

PRODUCTION OF SUPERCONDUCTOR/CARBON BICOMPONENT FIBERS **c76**

S. A. Wise, C. C. Fain, and H. D. Leigh *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 37-42 Sponsored in part by NSF (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Certain materials are unable to be drawn or spun into fiber form due to their improper melting characteristics or brittleness. However, fibrous samples of such materials are often necessary for the fabrication of intricate shapes and composites. In response to this problem, a unique process, referred to as the piggyback process, was developed to prepare fibrous samples of a variety of nonspinnable ceramics. In this technique, specially produced C shaped carbon fibers serve as micromolds to hold the desired materials prior to sintering. Depending on the sintering atmosphere used, bicomponent or single component fibers result. While much has been shown worldwide concerning the YBa2Cu3O(7-x) superconductor, fabrication into unique forms has proven quite difficult. However, a variety of intricate shapes are necessary for rapid commercialization of the superconducting materials. The potential for producing fibrous samples of the YBa2Cu3O(7-x) compound by the piggyback process is being studied. Various organic and acrylic materials were studied to determine suspending ability, reactivity with the YBa2Cu3O(7-x) compound during long term storage, and burn out characteristics. While many questions were answered with respect to the interfacial reactions between YBa2Cu3O(7-x) and carbon, much work is still necessary to improve the quality of the sintered material if the fibers produced are to be incorporated into useful composite or cables. Author

N92-21610*# Research Inst. of Industrial Science and Technology, Pohang (Republic of Korea). Physics Div.

THERMAL AND ELECTRIC PROPERTIES OF Nd(1.85)Ce(0.15)CuO(4-y) AND Pr(1.85)Ce(0.15)CuO(4-y) Abstract Only **c76**

Z. S. Lim, K. H. Han, Sung-Ik Lee, Yoon H. Jeong, Y. S. Song, and Y. W. Park (Seoul National Univ., Republic of Korea) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 43 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Electric resistivity, magnetic susceptibility, thermoelectric power, and Hall coefficient of Nd(1.85)Ce(0.15)CuO(4-y) and Pr(1.85)Ce(0.15)CuO(4-y) whose onset temperature of the superconductivity are 24 and 23 K were measured. Experimental results show many interesting features. In particular, the Hall coefficients are negative and relatively flat as a function of temperature. However, the temperature dependence of the thermoelectric power (TEP) for these two samples shows the positive sign for both samples in contrast to the previous results. Moreover, TEP for both samples remains flat in the normal state below 250 K, but decreases rapidly above 250 K. TEP of only Pr(1.85)Ce(0.15)CuO(4-y) shows a peak near 50 K. Finally, onset temperatures of sudden drop of TEP are higher than those of resistance drop. The physical properties of these samples produced at different conditions such as different heat treatment temperatures, atmospheres were also measured. TEP and resistance measurement show that oxygen deficiency is essential to produce better superconducting samples. Correlation between TEP and superconductivity for these different samples are discussed. Author

N92-21611*# Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Instituto de Ciencia de Materiales.

TERNARY AND QUATERNARY OXIDES OF Bi, Sr AND Cu **c76**

M. T. Casais, P. Millan, I. Rasines, and J. A. Campa (Universidad Complutense, Madrid, Spain) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 45-54 Sponsored in part by Fundacion Domingo Martinez (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Before the discovery of superconductivity in an oxide of Bi, Sr, and Cu, the system Bi-Sr-Cu-O had not been studied, although several solid phases had been identified in the two-component regions of the ternary system Bi2O3-Si-O-CuO. The oxides Sr2CuO3, SrCu2O2, SrCuO2, and Bi2CuO4 were then well known and characterized, and the phase diagram of the binary system Bi2O3-SrO had been established in the temperature range 620 to 1000 C. Besides nine solutions of compositions Bi(2-2x) Sr(x) O(3-2x) and different symmetries, this diagram includes three definite compounds of stoichiometries Bi(2)BrO4. Bi2Sr2O5, and Bi2Sr3O6 (x - 0.50, 0.67 and 0.75 respectively), only the second of which with known unit-cell of orthorhombic symmetry, dimensions (A) a = 14.293(2), b = 7.651(2), c = 6.172(1), and z = 4. The first superconducting oxide in the system Bi-Sr-Cu-O was initially formulated as Bi2Sr2Cu2O(7+x), with an orthorhombic unit-cell of parameters (A) a = 5.32, b = 26.6, c = 48.8. In a preliminary study the same oxide was formulated with half the copper content, Bi(2)Sr(2)CuO(6+x), and index its reflections assuming an orthorhombic unit-cell of dimensions (A) a = 5.390(2), b = 26.973(8), c = 24.69(4). Subsequent studies by diffraction techniques have confirmed the composition 2:2:1. A new family of oxygen-deficient perovskites, was characterized, after identifying by x ray diffraction the phases present in the products of thermal treatments of about 150 mixtures of analytical grade Bi2O3, Sr(OH)2-8H2O and CuO at different molar ratios. X ray diffraction data are presented for some other oxides of Bi and Sr, as well as for various quaternary oxides, among them an oxide of Bi, Sr, and Cu. Author

N92-21612*# West Virginia Univ., Morgantown. Dept. of Physics.

DEPENDENCE OF TRANSITION TEMPERATURE ON HOLE CONCENTRATION PER CuO2 SHEET IN THE Bi-BASED SUPERCONDUCTORS **c76**

J. Zhao and M. S. Seehra *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 55-59 Sponsored in part by DOE (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

The recently observed variations of the transition temperature (T sub c) with oxygen content in the Bi based (2212) and (2223) superconductors are analyzed in terms of p+, the hole concentration per CuO2 sheet. This analysis shows that in this system, T sub c increases with p+ initially, reaching maxima at p+ = 0.2 approx. 0.3, followed by monotonic decrease of T sub c with p+. The forms of these variations are similar to those observed in the La(2-x)Sr(x)CuO4 and YBa2Cu3Oy systems, suggesting that p+ may be an important variable governing superconductivity in the cuprate superconductors. Author

N92-21613*# Commissariat a l'Energie Atomique, Saclay (France).

SPIN GLASS FREEZING AND SUPERCONDUCTIVITY IN YBa2(Cu(1-x)Fe(x))3O7 ALLOYS **c76**

I. Mirebeau, M. Hennion, J. Dianoux, V. Caignaert, T. E. Phillips, and K. Moorjani (Johns Hopkins Univ., Laurel, MD.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 61-68 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

The dynamics were studied of the iron spins in superconducting YBa2(Cu(0.94)Fe(0.06))3O7 by neutron time of flight measurements. Two samples were studied with slightly different characteristics, as shown by resistivity and neutron diffraction measurements. The same dynamical anomalies are observed by neutrons in both samples. Differences appear qualitative but not quantitative. In the whole temperature range, the q-dependence of the magnetic intensity mainly reflects the magnetic form factor of iron which shows that the iron spins are almost uncorrelated. The elastic and quasielastic intensities strongly vary with temperature. A spin glass like freezing is revealed at low temperature by a sharp decrease of the quasielastic intensity, an increase of the 'elastic' or resolution limited intensity and a minimum in the quasielastic width. The freezing temperature (T sub f - 18 K) corresponds to that already determined by a magnetic splitting in Mossbauer experiments. Above T sub f, the relaxation of the iron spins in the paramagnetic state is modified by the occurrence of superconductivity. An increase was observed of the quasielastic intensity and of the quasielastic width at the superconducting transition. Author

N92-21614*# General Electric Co., Princeton, NJ. Astrospace Div.

THERMAL RESPONSE OF LARGE AREA HIGH TEMPERATURE SUPERCONDUCTING YBaCuO INFRARED BOLOMETERS **c76**

Ali E. Khalil *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 69-82 Submitted for publication (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Thermal analysis of large area high temperature superconducting infrared detector operating in the equilibrium mode (bolometer) was performed. An expression for the temperature coefficient beta = 1/R(dR/dT) in terms of the thermal conductance and the thermal time constant of the detector were derived. A superconducting transition edge bolometer is a thermistor consisting of a thin film superconducting YBaCuO evaporated into a suitable thermally isolated substrate. The operating temperature of the bolometer is maintained close to the midpoint of the superconducting transition region where the resistance R has a maximum dynamic range. A detector with a strip configuration was analyzed and an expression for the temperature rise (delta T) above the ambient due to a uniform illumination with a source of power density was calculated. An expression for the thermal responsibility depends upon the spatial modulation frequency and the angular frequency of the incoming radiation. The problem of the thermal cross talk between different detector elements was addressed. In the case of monolithic HTS detector array with a row of square elements of dimensions 2a and CCD or CID readout electronics the thermal spread function was derived for different spacing between elements. Author

N92-21615*# West Virginia Univ., Morgantown. Dept. of Chemistry.

MICROWAVE (EPR) MEASUREMENTS OF THE PENETRATION DEPTH MEASUREMENTS OF HIGH-Tc SUPERCONDUCTORS **c76**

N. S. Dalal, B. Rakvin, T. A. Mahl, A. S. Bhalla, and Z. Z. Sheng *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 83-88 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

The use is discussed of electron paramagnetic resonance (EPR) as a quick and easily accessible method for measuring the London penetration depth, lambda for the high T sub c superconductors. The method uses the broadening of the EPR signal, due to the emergence of the magnetic flux lattice, of a free radical adsorbed on the surface of the sample. The second moment, of the EPR signal below T sub c is fitted to the Brandt equation for a simple triangular lattice. The precision of this method compares quite

favorably with those of the more standard methods such as micro sup(+)SR, neutron scattering, and magnetic susceptibility.
Author

N92-21616*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
INHOMOGENEITIES IN SINGLE CRYSTALS OF CUPRATE OXIDE SUPERCONDUCTORS **c76**
K. Moorjani, J. Bohandy, B. F. Kim, and F. J. Adrian *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 89-95 (For primary document see N92-21605 12-24)
(Contract N00039-89-C-5031)
Avail: NTIS HC/MF A21 CSCL 20L

The next stage in the evolution of experimental research on the high temperature superconductors will require high quality single crystals and epitaxially grown crystalline films. However, inhomogeneities and other defects are not uncommon in single crystals of cuprate oxide superconductors, so a corollary requirement will be a reliable method for judging the quality of these materials. The application of magnetically modulated resistance methods in this task is briefly described and illustrated.
Author

N92-21617*# Naval Research Lab., Washington, DC.
THE COLOR OF POLARIZATION IN CUPRATE SUPERCONDUCTORS **c76**
H. A. Hoff, M. S. Osofsky, W. L. Lechter (Sachs/Freeman Associates, Inc., Landover, MD.), and C. S. Pande *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 97-106 Sponsored in part by Navy, DARPA, and Nuclear Defence Agency (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

A technique for the identification of individual anisotropic grains in a heterogeneous and opaque material involves the observation of grain color in reflected light through crossed polarizers (color of polarization). Such colors are generally characteristic of particular phases. When grains of many members of the class of hole carrier cuprate superconductors are so viewed at room temperature with a 'daylight' source, a characteristic color of polarization is observed. This color was studied in many of these cuprate superconductors and a strong correlation was found between color and the existence of superconductivity. Two members were also examined of the electron cuprate superconductors and it was found that they possess the same color of polarization as the hole carrier cuprate superconductors so far examined. The commonality of the characteristic color regardless of charge carrier indicates that the presence of this color is independent of carrier type. The correlation of this color with the existence of superconductivity in the cuprate superconductors suggests that the origin of the color relates to the origin of superconductivity. Photometric techniques are also discussed.
Author

N92-21618*# Ohio State Univ., Columbus. Dept. of Materials Science and Engineering.
EFFECT OF DOPING IN THE Bi-Sr-Ca-Cu-O SUPERCONDUCTOR **c76**
S. A. Akbar, M. S. Wong, M. J. Botelho, Y. M. Sung, M. Alauddin, C. E. Drummer, and M. J. Fair (Wagner Coll., Staten Island, NY.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 107-112 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The results of the effect of doping on the superconducting transition in the Bi-Sr-Ca-Cu-O system are reported. Samples were prepared under identical conditions with varying types (Pb, Sb, Sn, Nb) and amounts of dopants. All samples consisted of multiple phases, and showed stable and reproducible superconducting transitions. Stabilization of the well known 110 K phase depends on both the type and amount of dopant. No trace of superconducting phase of 150 K and above was observed.
Author

N92-21619*# Central Electronics Engineering Research Inst., Pilani (India). Semiconductor Devices Area.
STABILIZATION OF HIGH Tc PHASE IN BISMUTH CUPRATE SUPERCONDUCTOR BY LEAD DOPING Abstract Only **c76**
Ram. P. Gupta, J. P. Pachauri, W. S. Khokle, K. C. Nagpal, and S. K. Date (National Chemical Lab. of India, Poona.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 113-114 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

It has been widely ascertained that doping of lead in Bi-Sr-Ca-Cu-O systems promotes the growth of high T sub c (110 K) phase, improves critical current density, and lowers processing temperature. A systematic study was undertaken to determine optimum lead content and processing conditions to achieve these properties. A large number of samples with cationic compositions of Bi(2-x)Pb(x)Sr2Ca2Cu3 (x = 0.2 to 2.0) were prepared by conventional solid state reaction technique. Samples of all compositions were annealed together at a temperature and characterized through resistance temperature (R-T) measurements and x ray diffraction to determine the zero resistance temperature, T sub c(0) and to identify presence of phases, respectively. The annealing temperature was varied between 790 and 880 C to optimize processing parameters. Results are given. In brief, an optimum process is reported along with composition of leaded bismuth cuprate superconductor which yields nearly a high T sub c single phase with highly stable superconducting properties.
Author

N92-21620*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
STRUCTURE AND SUPERCONDUCTING PROPERTIES OF ((Ln(1-x)Ln*(x) 1/2 (Ba(1-y)Sr(y) 1/3 Ce 1/6)8Cu6O(z) Abstract Only **c76**
H. Yamauchi, T. Wada, A. Ichinose, Y. Taegashi, T. Kaneko, S. Ikegawa, and S. Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 115 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

A variety of new oxide superconductors were prepared. The crystallographic structures of the oxides were all tetragonal and of the (Ln(+),Ce)4(Ln(+),Ba)4Cu6Oz (Ln(+) = Nd, Sm or Eu) type which had been previously discovered by Akimitsu et al. As the Sr content, y, increased when Ln = Ln(excited state) = Nd, the oxygen content, z, monotonically increased and the superconducting transition temperature, T sub c, varied exhibiting a maximum. When z was controlled directly by means of high oxygen pressure sintering techniques, T sub c was changed accordingly. T sub c's of samples with different combinations of Ln and Ln(excited state) and different values of x and y were found to depend on the magnitude of the bond valence sum for a Cu atom located in the bottom plane of the Cu-O5 pyramid. Transport and magnetization measurements were carried out to investigate the magnetic field dependence of superconducting properties and to determine the phenomenological parameters. The Hall coefficients were positive below room temperature and varied yielding a maximum with respect to temperature.
Author

N92-21621*# Oslo Univ. (Norway). Dept of Chemistry.
COMPATIBILITIES OF YBa2Cu3O(9-DELTA) TYPE PHASE IN QUINTENARY SYSTEMS Y-Ba-Cu-O-X (IMPURITY) **c76**
P. Karen, O. Braaten, H. Fjellvag, and A. Kjekshus *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 117-126 Sponsored in part by Norwegian Council for Science and Humanities (For primary

document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Isothermal phase diagrams at various oxygen pressures were studied by powder diffraction and chemical analytical methods. The components, Y, Ba, Cu, and O (specifically O2, O2-, and O2 sup 2-) are treated, together with C (specifically CO2 and CO2 sup 2-), alkaline metals, Mg, alkaline earths, Sc, 3-d and 4-f elements. Effects of the substitutions at the structural sites of YBa2Cu3O(9-delta) on T sub c are discussed with respect to changes in crystallochemical characteristics of the substituted phase and to the nature of the substituents. Author

N92-21622*# National Inst. of Standards and Technology, Gaithersburg, MD. Ceramics Div.
PROCESSING Bi-Pb-Sr-Ca-Cu-O SUPERCONDUCTORS FROM AMORPHOUS STATE **c76**
C. K. Chiang, W. Wong-Ng, L. P. Cook, S. W. Freiman, N. M. Hwang, M. Vaudin, M. D. Hill, R. D. Shull, A. J. Shapiro, and L. J. Swartzendruber et al *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 127-136 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The bismuth based high T sub c superconductors can be processed via an amorphous Bi-Pb-Sr-Ca-Cu oxide. The amorphous oxides were prepared by melting the constituent powders in an alumina crucible at 1200 C in air followed by pouring the liquid onto an aluminum plate, and rapidly pressing with a second plate. In the amorphous state, no crystalline phase was identified in the powder x ray diffraction pattern of the quenched materials. After heat treatment at high temperature the amorphous materials crystallized into a glass ceramic containing a large fraction of the Bi2Sr2Ca2Cu3O(x) phase T sub c = 110 K. The processing method, crystallization, and results of dc electrical resistivity and ac magnetic susceptibility measurements are discussed. Author

N92-21623*# Academy of Sciences of the Moldavian SSR, Kishinev. Inst. of Applied Physics.
COMPOSITE SUPERCONDUCTING WIRES OBTAINED BY HIGH-RATE TINNING IN MOLTEN Bi-Pb-Sr-Ca-Cu-O SYSTEM **c76**
A. D. Grosav, L. A. Konopko, and N. I. Leporda *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 137-144 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Long lengths of metal superconductor composites were prepared by passing a copper wire through the bismuth based molten oxide system at a constant speed. The key to successful composite preparation is the high pulling speed involved, which permits minimization of the severe interaction between the unbuffered metal surface and the oxide melt. Depending on the temperature of the melt and the pulling speed, a coating with different thickness and microstructure appeared. The nonannealed thick coatings contained a Bi2(Sr,Ca)2Cu1O6 phase as a major component. After relatively short time annealing at 800 C, both resistivity and initial magnetization versus temperature measurements show superconducting transitions beginning in the 110 to 115 K region. The effects of annealing and composition on obtained results are discussed. This method of manufacture led to the fabrication of wire with a copper core in a dense covering with uniform thickness of about h approximately equal to 5 to 50 microns. Composite wires with h approximately equal to 10 microns (h/d approximately equal to 0.1) sustained bending on a 15 mm radius frame without cracking during flexing. Author

N92-21624*# University of South Florida, Tampa. Noise and Reliability Research Lab.
LOW FREQUENCY ELECTRICAL NOISE ACROSS CONTACTS BETWEEN A NORMAL CONDUCTOR AND SUPERCONDUCTING BULK YBa2Cu3O7 **c76**
J. Hall and T. M. Chen *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 145-148 (For primary document see N92-21605 12-24)
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Avail: NTIS HC/MF A21 CSCL 20L

Virtually every device that makes use of the new ceramic superconductors will need normal conductor to superconductor contacts. The current-voltage and electrical noise characteristics of these contacts could become important design considerations. I-V and low frequency electrical noise measurements are presented on contacts between a normal conductor and superconducting polycrystalline YBa2Cu3O7. The contacts were formed by first sputtering gold palladium pads onto the surface of the bulk superconductor and then using silver epoxy to attach a wire(s) to each pad. Voltage across the contacts was found for small current densities. The voltage spectral density, S sub v(f), a quantity often used to characterize electrical noise, very closely followed an empirical relationship given by S sub v(f) = C(VR)sq/f, where V is the DC voltage across the contact, R is the contact resistance, F is frequency, and C is a contant found to be 2 x 10(exp -10)/Omega sq at 78 K. This relationship was found to be independent of contact area, contact geometry, sample fabrication technique, and sample density. Author

N92-21625*# Saurashtra Univ., Rajkot (India). Dept. of Physics.
SUPERCONDUCTIVITY IN 2-2-3 SYSTEM Y2Ba2Cu2O(8+DELTA) **c76**
H. H. Joshi, G. J. Baldha, R. B. Jotania, S. M. Joshi, H. Mohan, P. B. Pandya, H. N. Pandya, and R. G. Kulkarni *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 149-153 Sponsored in part by University Grants Commission, New Delhi, India (For primary document see N92-21605 12-24)
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Researchers synthesized a new high T(sub c) 2-2-3 superconductor Y2Ba2Cu3O(8+delta) by a special preparation technique and characterized it by ac-susceptibility measurements. Diamagnetism and Meissner effect sets in at low fields and superconducting transition onsets at 90 K. The systematic investigation of the real and imaginary components of ac-susceptibility as a function of temperature and applied ac magnetic field reveals that the magnetic behavior is that of a granular type superconductor. Author

N92-21626*# Karachi Univ. (Pakistan). Solid State Research Lab.
STUDY OF THE SUPERCONDUCTING PROPERTIES OF THE Bi-Ca-Sr-Cu-O SYSTEM **c76**
Musheer H. Khan, S. M. M. R. Naqvi, and S. M. Zia-ul-Haq *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 155-158 Sponsored in part by National Scientific Research and Development Board, and Karachi Univ. (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

High Temperature Superconductivity in the Bi-Ca-Sr-Cu-O System has been observed and has attracted considerable attention in 1988. The 80 K superconductivity phase has been identified to have a composition of Bi2CaSr2Cu2Ox, while the 110 K phase as reported in the literature has a possible composition of Bi2Ca2Sr2Cu3O(x). Researchers present here a study of the electrical properties of bulk samples of the slowly cooled and rapidly quenched 2:1:2:2 system. The samples used in this study were prepared from appropriate amounts of Bi2O3, CuO, SrCO3, CaCO3. Author

N92-21627*# Sofia Univ. (Bulgaria). Faculty of Physics.
NOVEL SUPERCONDUCTING PHASES OF TI-BASED COMPOUNDS **c76**
I. Z. Kostadinov, M. Mateev, M. Michov, V. Skumriev, and E. Tsakin *In* NASA. Goddard Space Flight Center, AMSAHTS

1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 159-164 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Researchers report the measurements of the I(sub c)(T) of the 102 K phase. They also discuss briefly the composition of the lattice parameters and the ac susceptibility relation to the grain size and microstructure. Author

N92-21628*# Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Dept. of Electroceramics.
SYNTHESIS OF Y1BaCu3O(x) SUPERCONDUCTING POWDERS BY INTERMEDIATE PHASE REACTIONS **c76**
C. Moure, J. F. Fernandez, J. Tartaj, P. Recio, and P. Duran *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 165-172 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

A procedure for synthesizing Y1Ba2Cu3O(x) by solid state reactions was developed. The method is based on the use of barium compounds, previously synthesized, as intermediate phases for the process. The reaction kinetics of this procedure were established between 860 C and 920 C. The crystal structure and the presence of second phases were studied by means of XRD. The sintering behavior and ceramic parameters were also determined. The orthorhombic type-I structure was obtained on the synthesized bodies after a cooling cycle in an air atmosphere. Superconducting transition took place at 91 K. Sintering densities higher than 95 percent D sub th were attained at temperatures below 940 C. Author

N92-21629*# New York State Coll. of Ceramics, Alfred.
GRAIN ORIENTATION IN HIGH Tc SUPERCONDUCTORS BY MOLTEN SALT POWDER SYNTHESIS **c76**
Sudhakar Gopalakrishnan and Walter A. Schulze *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 173-180 Sponsored in part by New York State Institute of Superconductivity (For primary document see N92-21605 12-24)
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The molten salt or the flux method is used to fabricate a grain oriented YBa2Cu3O(7-x) (123) superconductor. Here we suggest a two-stage approach in using the 'green phase', Y2BaCuO5 (211), as seed crystals in the formation of YBa2Cu3O(7-x). The process uses Y2BaCuO5 formed by molten salt synthesis. The Y2BaCuO5 phase was observed to be stable in water and in most of the salt systems. Salt processing can form a small quantity of anisotropic particles of Y2BaCuO5. This material can form the 123 phase when tape cast and sintered in the presence of the required levels of Ba and Cu. Author

N92-21630*# National Inst. of Standards and Technology, Gaithersburg, MD. Material Science and Engineering Lab.
LEVITATION OF SUPERCONDUCTING COMPOSITES **c76**
C. K. Chiang, M. Turchinskaya, L. J. Swartzendruber, R. D. Shull, and L. H. Bennett *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 181-185 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The inverse levitation of a high temperature superconductor polymer composite consisting of powdered quench melt growth Ba2YCu3O(7-delta) and cyanoacrylate is reported. Magnetic hysteresis loop measurements for the composite are compared to those measured for the bulk material prior to powdering. Differences in the flux pining capability between the two material forms are small but significant. Author

N92-21631*# Barcelona Univ. (Spain). Dept. of Physics.
FLUX CREEP IN Bi2Sr2Ca1Cu2O(8+x) SINGLE CRYSTALS **c76**
E. Agostinelli, D. Fiorani, A. M. Testa, and J. Tejada *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 189-197 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Dissipative effects were investigated in Bi2Sr2Ca1Cu2O(8+x) single crystals by critical current and magnetic relaxation measurements. Activation energies for the flux motion were determined from the temperature dependence of the critical current and from the time decay of the zero field cooled and the remanent magnetization. The effective activation energy was found to increase with temperature, in agreement with the existence of a distribution of activation energies (E sub o 20 meV at 4.2 K for H + 10 kOe applied parallel to the c-axis.). Author

N92-21632*# University of South Florida, Tampa. Dept. of Electrical Engineering.
ELLIPTICAL FLUX VORTICES IN YBa2Cu3O7 **c76**
H. Hickman, A. J. Dekker, and T. M. Chen *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 199-201 (For primary document see N92-21605 12-24)
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The most energetically favorable vortex in YBa2Cu3O7 forms perpendicular to an anisotropic plane. This vortex is elliptical in shape and is distinguished by an effective interchange of London penetration depths from one axis of the ellipse to another. By generalizing qualitatively from the isotropic to the anisotropic case, we suggest that the flux flow resistivity for the vortex that forms perpendicular to an anistropic plane should have a preferred direction. Similar reasoning indicates that the Kosterlitz-Thouless transition temperature for a vortex mediated transition should be lower if the vortex is elliptical in shape. Author

N92-21633*# Maryland Univ., College Park. Dept. of Chemical and Nuclear Engineering.
VORTEX MOVEMENT AND MAGNETIZATION OF HIGH Tc SUPERCONDUCTORS **c76**
A. L. Roytburd and M. J. Turchinskaya (National Inst. of Standards and Technology, Gaithersburg, MD.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 203-212 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The basic characteristics of the thermoactivated vortex mobility in Y1Ba2Cu3O7 are determined by measurement of the kinetics of magnetization in two time regimes. The analysis of the kinetics of the approach of the equilibrium results in the activation energy, while the measurement of the log-creep rate allows determination of the activated moment. It is shown that the movement of vortices can be regarded as the diffusion process. Author

N92-21634*# National Inst. of Standards and Technology, Gaithersburg, MD. Materials Science and Engineering Lab.
FLUX FLOW AND FLUX DYNAMICS IN HIGH-Tc SUPERCONDUCTORS **c76**
L. H. Bennett, M. Turchinskaya, L. J. Swartzendruber, A. Roitburd, D. Lundy, J. Ritter, and D. L. Kaiser *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 213-229 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Because high temperature superconductors, including BYCO and BSSCO, are type 2 superconductors with relatively low H(sub c 1) values and high H(sub c 2) values, they will be in a critical state for many of their applications. In the critical state, with the applied field between H(sub c 1) and H(sub c 2), flux lines have penetrated the material and can form a flux lattice and can be

pinned by structural defects, chemical inhomogeneities, and impurities. A detailed knowledge of how flux penetrates the material and its behavior under the influence of applied fields and current flow, and the effect of material processing on these properties, is required in order to apply, and to improve the properties of these superconductors. When the applied field is changed rapidly, the time dependence of flux change can be divided into three regions, an initial region which occurs very rapidly, a second region in which the magnetization has a 1n(t) behavior, and a saturation region at very long times. A critical field is defined for depinning, H(sub c,p) as that field at which the hysteresis loop changes from irreversible to reversible. As a function of temperature, it is found that H(sub c,p) is well described by a power law with an exponent between 1.5 and 2.5. The behavior of H(sub c,p) for various materials and its relationship to flux flow and flux dynamics are discussed. Author

N92-21635*# Max-Planck-Inst. fuer Festkoerperforschung, Stuttgart (Germany, F.R.).
RIGID LEVITATION, FLUX PINNING, THERMAL DEPINNING AND FLUCTUATION IN HIGH-Tc SUPERCONDUCTORS c76
E. H. Brandt *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 230-239 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Here, the author shows that the strong velocity-independent frictional force on a levitating superconductor and on any type-II superconductor moving in a homogeneous magnetic field is caused by pinning and depinning of the magnetic flux lines in its interior. Levitation may thus be used to investigate the pinning properties of a superconductor, and friction in a superconductor bearing may be minimized by choosing appropriate materials and geometries. Author

N92-21636*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
COMPARATIVE STUDY OF FLUX PINNING, CREEP AND CRITICAL CURRENTS BETWEEN YBaCuO CRYSTALS WITH AND WITHOUT Y2BaCuO5 INCLUSIONS c76
Masato Murakami, Satoshi Gotoh, Hiroyuki Fujimoto, Naoki Koshizuka, and Shoji Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 241-248 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

In the Y-Ba-Cu-O system, YBa2Cu3O(x) phase is produced by the following peritectic reaction: Y2BaCuO5 + liquid yields 2YBa2Cu3O(x). Through the control of processing conditions and starting compositions, it becomes possible to fabricate large crystals containing fine Y2BaCuO5(211) inclusions. Such crystals exhibit Jc values exceeding 10000 A/sq cm at 77 K and 1T. Recently, researchers developed a novel process which can control the volume fraction of 211 inclusions. Elimination of 211 inclusions is also possible. In this study, researchers prepared YBaCuO crystals with and without 211 inclusions using the novel process, and compared flux pinning, flux creep and critical currents. Magnetic field dependence of Jc for YBaCuO crystals with and with 211 inclusions is shown. It is clear that fine 211 inclusions can contribute to flux pinning. It was also found that flux creep rate could be reduced by increasing flux pinning force. Critical current density estimates based on the conventional flux pinning theory were in good agreement with experimental results. Author

N92-21637*# National Inst. of Standards and Technology, Gaithersburg, MD. Materials Science and Engineering Lab.
LOWER CRITICAL FIELD MEASUREMENTS IN YBa2Cu3O(6+x) SINGLE CRYSTALS c76
D. L. Kaiser, L. J. Swartzendruber, F. W. Gayle, and L. H. Bennett *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 249-255 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The temperature dependence of the lower critical field in YBa2Cu3O(6+x) single crystals was determined by magnetization measurements with the applied field parallel and perpendicular to the c-axis. Results are compared with data from the literature and fitted to Ginzberg-Landau equations by assuming a linear dependence of the parameter kappa on temperature. A value of 7 plus or minus 2 kOe was estimated for the thermodynamic critical field at T = O by comparison of calculated H (sub c2) values with experimental data from the literature. Author

N92-21638*# Tokyo Univ. (Japan). Dept. of Industrial Chemistry.
OXIDE SUPERCONDUCTORS UNDER MAGNETIC FIELD Abstract Only c76
K. Kitazawa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 257 (For primary document see N92-21605 12-24)
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One of the current most serious problems for the oxide superconductors from the standpoint of practical application is the various novel features derived mainly from their extremely short coherence. In particular, the coherence length so far observed in the cuprate superconductors is in the range of 0.1 nm perpendicular to the CuO2 plane. This seems to be creating most of the difficulties in the device fabrication and in the performance under the magnetic field. Some of the superconducting properties under the magnetic field will be discussed in terms of the short coherence length. A model will be presented based on the gradual strengthening of the pinning force with decrease in temperature and the weak coupling at the grain boundaries. Secondly, the broadening of the superconducting transition under the magnetic field is discussed. This is observed significantly only when the field is applied perpendicular to the basal plane and the relative orientation of the current to the field is insignificant in determining the extent of broadening. Besides, the change in the strength of the pinning force does not affect the width of the broadening. From these observations discussions will be made on a model based on the giant fluctuation. Based on this model, it is predicted that the coherence length along the c-axis will be the single most important material parameter to determine the performance of the superconductor under a strong magnetic field. It seems that BYCO is superior in this regard to Bi- or Tl-systems as far as the performance at 77 K is considered, although another material with the coherence length slightly longer along the c-axis is still highly desired. Author

N92-21639*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MICROWAVE CONDUCTIVITY OF LASER ABLATED YBa2Cu3O(7-DELTA) SUPERCONDUCTING FILMS AND ITS RELATION TO MICROSTRIP TRANSMISSION LINE PERFORMANCE c76
K. B. Bhasin, J. D. Warner, C. M. Chorey, B. T. Ebihara, R. R. Romanofsky, V. O. Heinen, F. A. Miranda, and W. L. Gordon (Case Western Reserve Univ., Cleveland, OH.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 261-269 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The discovery of high temperature superconductor oxides has raised the possibility of a new class of millimeter and microwave devices operating at temperatures considerably higher than liquid helium temperatures. Therefore, materials properties such as conductivity, current density, and sheet resistance as a function of temperature and frequency, possible anisotropies, moisture absorption, thermal expansion, and others, have to be well characterized and understood. The millimeter wave response of laser ablated YBa2Cu3O(7-delta)/LaAlO3 thin films was studied as a function of temperature and frequency. In particular, the

evaluation of their microwave conductivity was emphasized, since knowledge of this parameter provides a basis for the derivation of other relevant properties of these superconducting oxides, and for using them in the fabrication of actual passive circuits. The microwave conductivity for these films was measured at frequencies from 26.5 to 40.0 GHz, in the temperature range from 20 to 300 K. The values of the conductivity are obtained from the millimeter wave power transmitted through the films, using a two fluid model. Author

N92-21640*# Oak Ridge National Lab., TN. Chemical Physics Section.

LASER SURFACE INTERACTION OF HIGH-Tc SUPERCONDUCTORS c76

C. H. Chen, M. P. McCann, and R. C. Phillips *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 271-278 (For primary document see N92-21605 12-24)

(Contract DE-AC05-84OR-21400)

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During the past two years, one of the most exciting research fields in science has been the study of the newly discovered high-T(sub c) metal oxide superconductors. Although many theoretical models were proposed, there is no general agreement on any theory to explain these materials. One of the peculiar features of these high-T(sub c) materials is the noninteger number of oxygen atoms. The oxygen content is extremely critical to the superconductive properties. Take YBa2Cu3O(7-x) as an example. Its superconductive properties disappear whenever x is larger than 0.5. The existence of Cu(+ 3) was considered to account for x less than 0.5. However, results from mass spectroscopy of laser desorbed species indicate that significant quantities of oxygen molecules are trapped in the bulk of these high-T(sub c) superconductors. It appears that these trapped oxygen molecules may play key roles in superconductive properties. Preparation of superconductive thin films are considered very important for the applications of these new superconductors for the electronics industry. Fluorescence spectra and ion spectra following laser ablation of high-temperature superconductors were obtained. A real time monitor for preparation of superconductive thin films can possibly be developed. Author

N92-21641*# Bell Communications Research, Inc., Red Bank, NJ.

PERSPECTIVES ON HIGH TEMPERATURE SUPERCONDUCTING ELECTRONICS Abstract Only c76

T. Venkatesan *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 279 (For primary document see N92-21605 12-24)

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The major challenges in making high temperature superconducting (HTSC) electronics viable are predominantly materials problems. Unlike their predecessors, the metal oxide-based superconductors are integratable with other advanced technologies such as opto-electronics and micro-electronics. The materials problems to be addressed relate to the epitaxial growth of high quality films, highly oriented films on non-lattice matched substrates, heterostructures with atomically sharp interfaces of junctions and other novel devices, and the processing of these films with negligible deterioration of the superconducting properties. These issues are illustrated with results based on films prepared in-situ by a pulsed laser deposition process. Films with zero-transition temperatures of 90 K and critical current densities of 5 x 10(exp 6) A/sq cm at 77 K have been prepared by this technique. Ultra-thin films, less than 100 A show T(sub c) is greater than 80 K, supporting the idea of two-dimensional transport in these materials. By the use of appropriate buffer layers, films with T(sub c) of 87 K and J(sub c) of 6 x 10(exp 4) A/sq cm were fabricated on silicon substrates. Submicron structures with J(sub c) is greater than 2 x 10(exp 7) at 10 K were fabricated. Results on nonlinear switching elements, IR detectors, and microwave studies will be briefly summarized. Author

N92-21642*# Matsushita Electric Industrial Co. Ltd., Osaka (Japan). Central Research Labs.

PREPARATION AND CHARACTERISTICS OF SUPERCONDUCTING CUPRATE THIN FILMS: Nd(2-x)Ce(x)CuO4 AND SUBSTRATED Bi-SYSTEM c76

H. Adachi, S. Hayashi, K. Setsune, S. Kohiki, Y. Ichikawa, and K. Wasa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 281-290 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Characteristics of the electron-doped-type Nd(sub 2-x)Ce(sub x)CuO4 system and substituted Bi-system were studied using the high quality thin film samples grown by rf magnetron sputtering and/or subsequent heat treatment. The Nd(sub 2-x)Ce(sub x)CuO4 samples with excellent superconducting properties were obtained in thin films and their optical and X-ray photoelectron spectroscopy (XPS) studies were performed with regard to the Ce content and reducing treatment. Substituted BiSr-Ln-Cu-O thin films were prepared and growth conditions for Bi-system with 2-2-1-2 and 2-2-2-2 phases were found. Moreover, a new 2-2-1-2 phase in the simple Bi-Sr-Cu-O system was fabricated by thin film processing and 80 K superconductivity was obtained. Author

N92-21643*# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

HIGH-T(c) SQUID APPLICATION IN MEDICINE AND GEOPHYSICS c76

V. N. Polushkin, S. V. Uchaikin, and B. V. Vasiliev *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 291-295 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

In our laboratory of high-T(sub c), a one-hole squid was built from Y1Ba2Cu3O(7-x) ceramics obtained by a standard procedure of solid state reaction. The ceramics with critical current density J(sub c) is greater than 100 A/sq cm was selected. In the middle of a 10 x 10 x 2 mm ceramics pellet, a 0.8 mm hole was drilled in which the superconducting loop of the squid was located. Between the hole and the edge of the pellet, a cut was mechanically filed out with a bridge inside it connecting the superconducting ring. A scheme of the magnetometer is presented. The resonant frequency shift of the tank circuit, the connection of the squid with this circuit, and the squid inductance are evaluated. One of the most interesting fields of the squid-based magnetometer application is biomagnetism, particularly, the human heart magnetocardiogram measuring. The low-temperature squids were used in this area and many interesting and important scientific results have been obtained. The observations have shown that the main noise contribution was not due to the squid but to the Earth's magnetic field variations, industrial inductions, and mainly to the vibrations caused by liquid nitrogen boiling and by vibrations of the box. Further attempts are needed to reduce the magnetic noise inductions. Nevertheless, the estimations promise the maximum signal/noise relation of the high-T(sub c) squid-magnetocardiometer to be not less than 10:1 in a bandwidth of 60 Hz. Apparently, such resolution would be enough not only for steady cardiogram reading but even for thin structure investigation at average technique application. Author

N92-21644*# Istituto Nazionale di Fisica Nucleare, Rome (Italy). Dip. di Fisica.

MICROSTRUCTURES AND PROPERTIES OF SUPERCONDUCTING Y-ErBaCuO THIN FILMS OBTAINED FROM DISORDERED Y-ErBaF2Cu FILMS c76

P. Cikmach, M. Diociaiuti, A. Fontana, C. Giovannella, M. Iannuzzi, C. Lucchini, V. Merlo, R. Messi, L. Paoluzi, and L. Scopa (Consiglio Nazionale delle Ricerche, Rome, Italy) et al *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials

Science and Applications of High Temperature Superconductors Jan. 1991 p 297-305 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The preparation procedure used to obtain superconducting thin films by radio frequency magnetron sputtering of a single mosaic target is described in detail. The single mosaic target is composed of (Y-Er), BaF2, and Cu. K.S.

N92-21645*# Johns Hopkins Univ., Baltimore, MD. Dept. of Electrical and Computer Engineering.
OPTICAL AND MICROWAVE DETECTION USING Bi-Sr-Ca-Cu-O THIN FILMS c76
B. E. Grabow, R. M. Sova, B. G. Boone, K. Moorjani, B. F. Kim, J. Bohandy, F. Adrian, and W. J. Green *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 307-316 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Recent progress at the Johns Hopkins University Applied Physics Laboratory (JHU/APL) in the development of optical and microwave detectors using high temperature superconducting thin films is described. Several objectives of this work have been accomplished, including: deposition of Bi-Sr-Ca-Cu-O thin films by laser abation processing (LAP); development of thin film patterning techniques, including in situ masking, wet chemical etching, and laser patterning; measurements of bolometric and non-bolometric signatures in patterned Bi-Sr-Ca-Cu-O films using optical and microwave sources, respectively; analysis and design of an optimized bolometer through computer simulation; and investigation of its use in a Fourier transform spectrometer. The focus here is primarily on results from the measurement of the bolometric and non-bolometric response. Author

N92-21646*# Oklahoma Univ., Norman. School of Electrical Engineering and Computer Science.
IN-SITU INTEGRATED PROCESSING AND CHARACTERIZATION OF THIN FILMS OF HIGH TEMPERATURE SUPERCONDUCTORS, DIELECTRICS AND SEMICONDUCTORS BY MOCVD Abstract Only c76
R. Singh, S. Sinha, N. J. Hsu, R. P. S. Thakur, P. Chou, A. Kumar, and J. Narayan (North Carolina State Univ., Raleigh.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 317 (For primary document see N92-21605 12-24)
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In this strategy of depositing the basic building blocks of superconductors, semiconductors, and dielectrics having common elements, researchers deposited superconducting films of Y-Ba-Cu-O, semiconductor films of Cu2O, and dielectric films of BaF2 and Y2O3 by metal oxide chemical vapor deposition (MOCVD). By switching source materials entering the chamber, and by using direct writing capability, complex device structures like three terminal hybrid semiconductor/superconductor transistors can be fabricated. The Y-Ba-Cu-O superconducting thin films on BaF2/YSZ substrates show a T(sub c) of 80 K and are textured with most of the grains having their c-axis or a-axis perpendicular to the substrate. Electrical characteristics as well as structural characteristics of superconductors and related materials obtained by x-ray deffraction, electron microscopy, and energy dispersive x-ray analysis are discussed. Author

N92-21647*# Fujitsu Ltd., Atsugi (Japan).
MAGNETIC RELAXATION IN THE 110 K SUPERCONDUCTING PHASE IN Bi-Sr-Ca-Cu-O THIN FILMS c76
Atsushi Tanaka, Jason Crain, Nobuo Kamehara, and Koichi Niwa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 319-322 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

We have investigated the time dependence of remnant moment decay in a highly oriented, nearly single high T(sub c) phase Bi-Sr-Ca-Cu-O thin film. A strictly logarithmic time dependence was observed over a 20 K temperature range for observation intervals of 2000 seconds. The normalized decay rate exhibits a peak around 14 K and has a relatively weak magnetic field dependence. These data are then compared with existing data on the YBCO and Eu-based superconductors. Author

N92-21648*# Emcore Corp., Somerset, NJ.
IN-SITU DEPOSITION OF YBCO HIGH-Tc SUPERCONDUCTING THIN FILMS BY MOCVD AND PE-MOCVD c76
J. Zhao, D. W. Noh, C. Chern, Y. Q. Li, P. E. Norris, B. Kear, and B. Gallois (Stevens Inst. of Tech., Hoboken, NJ.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 323-330 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Metal-Organic Chemical Vapor Deposition (MOCVD) offers the advantages of a high degree of compositional control, adaptability for large scale production, and the potential for low temperature fabrication. The capability of operating at high oxygen partial pressure is particularly suitable for in situ formation of high temperature superconducting (HTSC) films. Yttrium barium copper oxide (YBCO) thin films having a sharp zero-resistance transition with T(sub c) greater than 90 K and J(sub c) of approximately 10(exp 4) A on YSZ have been prepared, in situ, at a substrate temperature of about 800 C. Moreover, the ability to form oxide films at low temperature is very desirable for device applications of HTSC materials. Such a process would permit the deposition of high quality HTSC films with a smooth surface on a variety of substrates. Highly c-axis oriented, dense, scratch resistant, superconducting YBCO thin films with mirror-like surfaces have been prepared, in situ, at a reduced substrate temperature as low as 570 C by a remote microwave-plasma enhanced metal-organic chemical vapor deposition (PE-MOCVD) process. Nitrous oxide was used as a reactant gas to generate active oxidizing species. This process, for the first time, allows the formation of YBCO thin films with the orthorhombic superconducting phase in the as-deposited state. The as-deposited films grown by PE-MOCVD show attainment of zero resistance at 72 K with a transition width of about 5 K. MOCVD was carried out in a commercial production scale reactor with the capability of uniform deposition over 100 sq cm per growth run. Preliminary results indicate that PE-MOCVD is a very attractive thin film deposition process for superconducting device technology. Author

N92-21649*# Drexel Univ., Philadelphia, PA. Dept. of Physics and Atmospheric Science.
AN EXPLANATION FOR THE RISE IN Tc IN THE Tl- AND Bi-BASED HIGH TEMPERATURE SUPERCONDUCTORS Abstract Only c76
S. M. Bose and P. Longe (Liege Univ., Belgium) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 331 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Using the plasmon exchange model for the high T(sub c) superconductor, it is shown that the T(sub c) rises with an increase in the number of CuO layers per unit cell, which is in agreement with recent observations in the Tl- and Bi-based compounds. The calculation also suggests that the sample will become superconducting in successive stages and that there is a saturation effect, i.e., that T(sub c) cannot be raised indefinitely by increasing the number of CuO layers. Author

N92-21650*# IBM Research Lab., Yorktown Heights, NY.
CRITICAL CURRENTS AND HIGH-TEMPERATURE SUPERCONDUCTORS Abstract Only c76

P. Chaudhari *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 333 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Experimental information on critical currents and epitaxial thin films of high temperature superconductors is summarized. Experiments performed to measure critical currents across single grain boundaries are described. A variety of mechanisms responsible for limiting currents in films as well as across grain boundaries are presented and their predictions compared with experimental data. Author

N92-21651*# Stanford Univ., CA. Dept. of Physics.
THE SUPERCONDUCTING STATE OF THE HIGH-TRANSITION TEMPERATURE SUPERCONDUCTORS: EXPERIMENTAL BASIS Abstract Only **c76**
W. A. Little *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 337 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Experiments on the high-T(sub c) cuprate superconductors continue to narrow the possible theoretical explanations of the phenomenon. Experimental evidence to date points to a BCS-like state, with pairs in singlet s-states, the familiar gap in the excitation spectrum, Type 2 behavior in a magnetic field, and a normal state with fermi liquid origins. Several other features of the superconducting state in the cuprates, however, appear to differ from those of conventional alloy superconductors (these relate to the detailed structure of the gap and to the nature of the coupling mechanism). Recent experiments have helped clarify what these differences are, and together with the earlier experiments, they now impose still stronger constraints on theories of these superconductors. These and other developments are reviewed. Author

N92-21652*# Bell Telephone Labs., Inc., Murray Hill, NJ.
PHENOMENOLOGICAL THEORY OF THE NORMAL AND SUPERCONDUCTIVE STATES OF Cu-O AND Bi-O METALS Abstract Only **c76**
C. M. Varma *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 339 (For primary document see N92-21605 12-24)
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The universal normal state anomalies in the CuO metals follow from a marginal Fermi liquid hypothesis: there exists a contribution to the polarizability over most of momentum space proportional to omega/T for omega/T much less than 1 and constant thereafter up to a cutoff omega(sub c). Using the same excitation spectrum, the properties of the superconductive state were calculated. The right order of T(sub c) can be obtained, the zero temperature gap, 2 delta (0)/T(sub c) and the nuclear relaxation rate near T(sub c). The possible microscopic physics leading to the marginal Fermi liquid hypothesis is discussed. Author

N92-21653*# Centre National de la Recherche Scientifique, Grenoble (France).
CHARGE TRANSFER POLARISATION WAVE IN HIGH Tc OXIDES AND SUPERCONDUCTIVE PAIRING **c76**
B. K. Chakraverty *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 341-351 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

A general formalism of quantized charge transfer polarization waves was developed. The nature of possible superconductive pairing between oxygen holes is discussed. Unlike optical phonons, these polarization fields will give rise to dielectric bipolarons or bipolaron bubbles. In the weak coupling limit, a new class of superconductivity is to be expected. Author

N92-21654*# California Univ., Berkeley. Lawrence Berkeley Lab.
CORRELATION OF NORMAL AND SUPERCONDUCTING PROPERTIES AND UNIFIED APPROACH TO THE DESCRIPTION OF HIGH Tc OXIDES **c76**
V. Z. Kresin and S. A. Wolf (Naval Research Lab., Washington, DC.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 353-364 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

We present a unified approach based on the Fermi liquid picture which allows us to describe the normal as well as the superconducting properties of the doped cuprates. The theory that is presented is for the doped compounds which are metallic. One can distinguish two interrelated, but nevertheless, different directions in the physics of high T(sub c): one involving the problem of carrier doping and the transition to the metallic state, and the second being the description of the metallic state. It is important that this metallic phase undergoes the transition into the superconducting state; as a result, our analysis is directly related to the origin of high T(sub c). We are using a quasi-2D Fermi liquid model to estimate the fundamental parameters of these very interesting materials. We find that this description is able to describe these materials and also that phonons and plasmons play a major role in the mechanism of high T(sub c). Author

N92-21655*# Northwestern Univ., Evanston, IL. Dept. of Physics and Astronomy.
ELECTRONIC STRUCTURE FERMI LIQUID THEORY OF HIGH Tc SUPERCONDUCTORS: COMPARISON OF PREDICTIONS WITH EXPERIMENTS **c76**
Jaejun Yu and A. J. Freeman *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 365-371 Sponsored in part by NASA. Ames Research Center (For primary document see N92-21605 12-24)
(Grant NSF DMR-88-21571)
Avail: NTIS HC/MF A21 CSCL 20L

Predictions of local density functional (LDF) calculations of the electronic structure and transport properties of high T(sub c) superconductors are presented. As evidenced by the excellent agreement with both photoemission and positron annihilation experiments, a Fermi liquid nature of the 'normal' state of the high T(sub c) superconductors become clear for the metallic phase of these oxides. In addition, LDF predictions on the normal state transport properties are qualitatively in agreement with experiments on single crystals. It is emphasized that the signs of the Hall coefficients for the high T(sub c) superconductors are not consistent with the types of dopants (e.g., electron-doped or hole-doped) but are determined by the topology of the Fermi surfaces obtained from the LDF calculations. Author

N92-21656*# Johns Hopkins Univ., Baltimore, MD. Dept. of Physics and Astronomy.
INCOHERENT VS. COHERENT BEHAVIOR IN THE NORMAL STATE OF COPPER OXIDE SUPERCONDUCTORS Abstract Only **c76**
Zlatko Tesanovic *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 373-374 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The self-consistent quantum fluctuations around the mean-field Hartree-Fock state of the Hubbard model provide a very good description of the ground state and low temperature properties of a 2-D itinerant antiferromagnet. Very good agreement with numerical calculations and experimental data is obtained by including the one- and two-loop spin wave corrections to various physical quantities. In particular, the destruction of the long-range order above the Neel temperature can be understood as a spontaneous generation of a length-scale epsilon(T), which should be identified as the spin correlation length. For finite doping, the

question of the Hartree-Fock starting point becomes a more complex one since an extra hole tends to self-trap in antiferromagnetic background. Such quantum defects in an underlying antiferromagnetic state can be spin-bags or vortex-like structures and tend to suppress the long-range order. If motion of the holes occurs on a time-scale shorter than the one associated with the motion of these quantum defects of a spin background, one obtains several important empirical features of the normal state of CuO superconductors like linear T-dependence of resistivity, the cusp in the tunneling density of states, etc. As opposed to a familiar Fermi-liquid behavior, the phenomenology of the above system is dominated by a large incoherent piece of a single hole propagator, resulting in many unusual normal state properties. Author

N92-21657*# Pennsylvania State Univ., University Park.
THE ELECTRONIC HAMILTONIAN FOR CUPRATES Abstract Only **c76**
James F. Annett, A. K. McMahan, and Richard M. Martin (Illinois Univ., Urbana-Champaign.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 375 (For primary document see N92-21605 12-24)
(Contract W-7405-eng-48; NSF DMR-86-12860)
Avail: NTIS HC/MF A21 CSCL 20L

A realistic many-body Hamiltonian for the cuprate superconductors should include both copper d and oxygen p states, hopping matrix elements between them, and Coulomb energies, both on-site and inter-site. We have developed a novel computational scheme for deriving the relevant parameters ab initio from a constrained occupation local density functional. The scheme includes numerical calculation of appropriate Wannier functions for the copper and oxygen states. Explicit parameter values are given for La2CuO4. These parameters are generally consistent with other estimates and with the observed superexchange energy. Secondly, we address whether this complicated multi-band Hamiltonian can be reduced to a simpler one with fewer basis states per unit cell. We propose a mapping onto a new two-band effective Hamiltonian with one copper d and one oxygen p derived state per unit cell. This mapping takes into account the large oxygen-oxygen hopping given by the ab initio calculations. Author

N92-21658*# Silesian Medical Academy, Katowice (Poland). Inst. of Physics.
THE RELATION BETWEEN FERROELASTICITY AND SUPERCONDUCTIVITY Abstract Only **c76**
A. Molak and R. Manka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 377-378 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

The high-temperature superconductivity is explained widely by the layered crystal structure. The one- and two-dimensional subsystems and their interaction are investigated here. It is assumed that the high-T(sub c) superconductivity takes place in the two-dimensional subsystem and the increase of the phase transition temperature from 60 K up to 90 K is the consequence of turning on the influence of one-dimensional chains. The interaction between the two subsystems is transferred along the c axis by the phonons of breathing mode, which causes the hybridization of the electronic bonds between these subsystems. The experimental works indicate that the existence of both the chains Cu(1)-O and their interaction with the superconducting plane of Cu(2)-O modify the temperature of the transition to the superconducting state. It is seen from the neutron scattering data that the rates of the interatomic distance dependencies on temperature are changed around 240 K and 90 K. The 'zig-zag' order in Cu(1)-O chains has been postulated but, on the other hand, the vibrations with a large amplitude only were reported. The bi-stabilized situation of the oxygen ions can be caused by the change of distance between these ions and the Ba ions. It leads to the appearance of a two-well potential. Its parameters depend on temperature and the dynamics of the oxygen ions' movement. They can induce the antipolar order, which can be, however, more or less chaotic. The investigation of the ferroelastic properties of Y-Ba-Cu-O samples lead to the conclusion that they are related to jumps of ions inside the given chain and not to a diffusion between different sites in the ab plane. Researchers deduce, thus, that the fluctuating oxygen ions from these chains create dipoles in the ab plane. They can be described with the pseudo-spin formalism (- Pauli matrices). The system can be described with the Ising model. The pseudo-spins interact with phonons and influence the superconductivity in the second subsystem. Author

N92-21659*# Army Materials Technology Lab., Watertown, MA. Materials Science Branch.
HIGH Tc SUPERCONDUCTORS: THE SCALING OF Tc WITH THE NUMBER OF BOUND HOLES ASSOCIATED WITH CHARGE TRANSFER NEUTRALIZING THE MULTIVALENCE CATIONS **c76**
G. C. Vezzoli, M. F. Chen, and F. Craver *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 379-383 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

It is observed that for the known high-T(sub c) Cu-, Tl-, and Bi-based superconductors, T(sub c) scales consistently with the number of bound holes per unit cell which arise from charge transfer excitations of frequency approximately = 3 x 10(exp 13) that neutralized the multivalence cations into diamagnetic states. The resulting holes are established on the oxygens. Extrapolation of this empirical fit in the up-temperature direction suggests a T(sub c) of about 220-230 K at a value of 25 holes/unit cell (approximately the maximum that can be materials-engineered into a high-T(sub c) K2MnF4 or triple Perovskite structure). In the down-temperature direction, the extrapolation gives a T(sub c) in the vicinity of 235 K for the Y-Ba-Cu-O system as well as the known maximum temperature of 23 K for low-T(sub c) materials shown by Nb3Ge. The approach is also consistent with the experimental findings that only multivalence ions which are diamagnetic in their atomic state (Cu, Tl, Bi, Pb, and Sb) associate with high-T(sub c) compounds. Author

N92-21660*# Academy of Sciences (USSR), Svierdlovsk. Inst. of Chemistry.
ELECTRON ENERGY SPECTRUM AND MAGNETIC INTERACTIONS IN HIGH-Tc SUPERCONDUCTORS **c76**
S. A. Turshevski, A. I. Liechtenstein, V. P. Antropov, and V. A. Gubanov *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 385-387 (For primary document see N92-21605 12-24)
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The character of magnetic interactions in La-Sr-Cu-O and Y-Ba-Cu-O systems is of primary importance for analysis of high-T(sub c) superconductivity in these compounds. Neutron diffraction experiments showed the antiferromagnetic ground state for nonsuperconducting La2CuO4 and YBa2Cu3O6 with the strongest antiferromagnetic superexchange being in the ab plane. The nonsuperconducting '1-2-3' system has two Neel temperatures T(sub N1) and T(sub N2). The first one corresponds to the ordering of Cu atoms in the CuO2 planes; T(sub N2) reflects the antiferromagnetic ordering of magnetic moments in CuO chains relatively to the moments in the planes T(sub N1) and T(sub N2) which depend strongly on the oxygen content. Researchers describe magnetic interactions in high-T superconductors based on the Linear Muffin-Tin Orbitals (LMTO) band structure calculations. Exchange interaction parameters can be defined from the effective Heisenberg Hamiltonian. When the magnetic moments are not too large, as copper magnetic moments in superconducting oxides, J(sub ij) parameters can be defined through the non-local magnetic susceptibility of spin restricted solution for the crystal. The results of nonlocal magnetic susceptibility calculations and

the values of exchange interaction parameters for La CuO and YBa2Cu3O7 systems are given in tabular form. Strong anisotropy of exchange interactions in the ab plane and along the c axis in La2CuO4 is obviously seen. The value of Neel temperature found agrees well with the experimental data available. In the planes of '1-2-3' system there are quite strong antiferromagnetic Cu-O and O-O interaction which appear due to holes in oxygen subbands. These results are in line with the magnetic model of oxygen holes pairing in high-T(sub c) superconductors. Author

N92-21661*# Pedigogical Univ., Czestochowa (Poland).
COUPLED BIPOLARONS AND OPTICAL PHONONS AS A MODEL FOR HIGH-Tc SUPERCONDUCTORS c76
J. Kasperczyk *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 389-392 (For primary document see N92-21605 12-24)
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The coherence length of the new high-temperature superconductors reaches a small value which is comparable to the dimensions of the unit cell of the compound. This means that a pair consists of two holes occupying the same site or two adjacent sites. Such a situation is described by a model of the local-pairs (bipolarons). The origin of local-pairs may come not only from strong enough electron or hole-phonon interaction but also from other interactions. Independent of the specific nature of such local-pairs, they can undergo a Bose-like condensation to the superconducting state at a critical temperature which is usually much lower than the temperature of the pair formation. An interplay of ferroelectric and superconducting properties is considered within the model of hole-like local-pairs interacting with optical phonons. Therefore, researchers extend the usual local-pair Hamiltonian by including a direct interaction between the local-pairs and the optical phonons. These optical phonons are known to play an important role in the ferroelectric transition and they transform into an additional pseudo-acoustic branch at the ferroelectric critical temperature. (This is associated with nonzero electric polarization due to the existence of two separate lattices composed of negative and positive ions, respectively.) Author

N92-21662*# Polish Academy of Sciences, Warsaw. Inst. of Physics.
XES STUDIES OF DENSITY OF STATES OF HIGH TEMPERATURE SUPERCONDUCTORS Abstract Only c76
Gabriel Jasiolek *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 393 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

X-ray emission spectroscopic studies concerning the superconducting crystals, thin films, and ceramics of the Y-Ba-Cu-O, Tm-Ba-Cu-O, Bi-Sr-Ca-Cu-O, Bi-Pb-Sr-Ca-Cu-O, and Tl-Ba-Ca-Cu-O types are presented. The contributions of the 13d(9)L, 13d(10)L, 13d(10)LL, and 13d(10)L(2) configurations, where L denotes a ligand hole at the oxygen orbitals in the spectroscopic pattern of these superconductors are discussed. An attempt to connect the x-ray 'as registered' Cu L(alpha) emission spectra with the density of states close to the Fermi level, considering an influence of the CuL3 absorption edge, is presented. The corrected intensity distributions below the Fermi level are found to correspond to the theoretical density of states. Furthermore, an approach to the average valence of copper basing on the account of the self-absorption and fluorescence effects and on the configurations listed above is shown. The average valence of copper in the materials investigated is estimated to lie in the range of +2.10 to 2.32 when the formal trivalent copper is considered as that characterized by the 13d(9)L configuration. The density of states at the Fermi level was estimated to be 2.4 states/eV-cell for a Bi-Sr-Ca-Cu-O crystal and 3.6 states/eV-cell for a Tl-Ba-Ca-CU-O ceramic. Author

N92-21663*# Academy of Sciences (USSR), Moscow. Inst. of Physics.
SUPERCONDUCTIVITY IN THE Sn-Ba-Sr-Y-Cu-O SYSTEM Abstract Only c76
K. S. Aleksandrov, B. P. Khrustalev, S. N. Krivomazov, M. I. Petrov, A. D. Vasilyev, and S. A. Zwegintsev *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 395-396 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

After the discovery of high-T(sub c) superconductivity in the La-Ba-Cu-O compound, several families of superconducting oxides were synthesized. Here, researchers report the results of the search for superconductivity in the compounds based on tin which has a lone electron pair like Bi, Tl, and Pb. The following compounds were synthesized: Sn1Ba1Sr1Cu3O(sub x), Sn1Ba1Ca1Cu3O(sub x), Sn1Ba1Mg1Cu3O(sub x), Sn1Sr1Ca1Cu3O(sub x), Sn1Sr1Mg1Cu3O(sub x), and Sn1Ca1Mg1Cu3O(sub x). The initial components were oxides and carbonates of the appropriate elements. A standard firing-grinding procedure was used. Final heating was carried out at 960 C during 12 hours. Then the samples were cooled inside the furnace. All the synthesis cycles were carried out in air atmosphere. Among the synthesized compounds only Sn1Ba1Sr1Cu3O(sub x) showed remarkable conductivity. Other compounds were practically dielectrics. Presence of a possible superconductivity in Sn1Ba1Sr1Cu3O(sub x) was defined by using the Meissner effect. At low temperature a deviation from paramagnetic behavior is observed. The hysteresis loops obtained at lower temperature undoubtly testify to the presence of a superconductive phase in the sample. However, the part of the superconductive phase in the Sn1Ba1Sr1Cu3O(sub x) ceramic turned out to be small, less than 2 percent, which agrees with the estimation from magnetic data. In order to increase the content of the superconductive phase, two-valent cations Ba and Sr were partially substituted by univalent (K) and three-valent ones (Y). Author

N92-21664*# Connecticut Univ., Storrs. Dept. of Physics.
STUDIES OF LOCAL MAGNETISM AND LOCAL STRUCTURE IN La(2-x)Sr(x)CuO4 Abstract Only c76
J. I. Budnick, Z. Tan, and M. Filipkowski *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 397-398 Sponsored in part by Dept. of Higher Education, State of Connecticut (For primary document see N92-21605 12-24)
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The muon spin rotation (MUSR) study of local magnetism of Sr-doped La2CrO4 is reviewed. Emphasis is placed on magnetic order as detected by local and bulk probes with local atomic environments studies by x ray absorption fine structure (XAFS). Correlations between the MUSR study of local magnetic ordering and the bulk magnetization study are presented along with a discussion of the dependence upon oxygen stoichiometry. Results are presented for both superconducting phases and magnetic phases. Recent data which reveals the existence of local magnetic ordering in the hydrogen-doped YBa2Cu3O7 system are also discussed. Author

N92-21665*# Pavia Univ. (Italy). Dipt. di Fisica.
MAGNETIC CORRELATIONS IN La(2-x)Sr(x)CuO4 FROM NQR RELAXATION AND SPECIFIC HEAT c76
F. Borsa and A. Rigamonti (Iowa State Univ. of Science and Technology, Ames.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 399-411 Sponsored in part by INFN and INFM-GNSM (For primary document see N92-21605 12-24)
(Contract W-7405-eng-82; INFN-MSC-1990-92)
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La-139 and Cu-63 Nuclear Quadrupole Resonance (NQR)

relaxation measurements in La(2-x)Sr(x)CuO4 for x ranging from 0 up to 0.3, with particular emphasis on the effect of doping on the Cu(2+) magnetic correlations and dynamics, are reviewed. In the low doping limit, x less than or equal to 0.05, the results can be interpreted consistently in terms of a simple phenomenological 'two-fluids' model whereby the effect of thermally-activated mobile O(2p) holes is the one of disrupting locally the Cu(2+) spin correlations. For x greater than or equal to 0.1, the results indicate the onset, as T approaches T(sub c)(+), of a strong coupling between Cu(2+) spins and the Fermi liquid of O(2p) holes leading to the apparent disappearance of localized Cu(2+) moment in connection with the opening of a superconducting gap. Author

N92-21666*# South Carolina Univ., Columbia. Dept. of Astronomy.

MAGNETISM AND SUPERCONDUCTIVITY OF SOME Tl-Cu OXIDES Abstract Only **c76**

Timir Datta *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 413 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Many copper oxide based Thallium compounds are now known. In comparison to the Bi-compounds, the Tl-system shows a richer diversity; i.e., High Temperature Superconductors (HTSC) can be obtained with either one or two Tl-0 layers (m = 1,2); also, the triple-digit phases are easier to synthesize. The value of d, oxygen stoichiometry, is critical to achieving superconductivity. The Tl system is robust to oxygen loss; Tl may be lost or incorporated by diffusion. A diffusion coefficient equal to 10 ms at 900 C was determined. Both ortho-rhombic and tetragonal structures are found, but HTSC behavior is indifferent to the crystal symmetry. This system has the highest T(sub c) confirmed. T(sub c) generally increases with p, the number of CuO layers, but tends to saturate at p = 3. Zero resistance was observed at temperatures as great as 125 K. Most of these HTSC's are hole type, but the Ce-doped specimens may be electronic. The magnetic aspects were studied; because in addition to defining the perfectly diamagnetic ground state as in conventional superconductors, magnetism of the copper oxides show a surprising variety. This is true of both the normal and the superconducting states. Also, due to the large phonon contribution to the specific heat at the high T(sub c) jump, electronic density of states, D(Ef), and coherence length are uncertain, and thus, are estimated from the magnetic results. Results from the Tl-system CuO, LaBaCuO,120 and the Bi-CuO compounds are discussed. The emphasis is on the role of magnetism in the Tl-CuO HTSC, but technological aspects are also pointed out. Author

N92-21667*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

A TECHNIQUE TO MEASURE THE THERMAL DIFFUSIVITY OF HIGH Tc SUPERCONDUCTORS **c76**

Charles E. Powers *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 417-421 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

High T(sub c) superconducting electrical current leads and ground straps will be used in cryogenic coolers in future NASA Goddard Space Flight Center missions. These superconducting samples are long, thin leads with a typical diameter of two millimeters. A longitudinal method is developed to measure the thermal diffusivity of candidate materials for this application. This technique uses a peltier junction to supply an oscillatory heat wave into one end of a sample and will use low mass thermocouples to follow the heat wave along the sample. The thermal diffusivity is calculated using both the exponential decay of the heat wave and the phase shift to the wave. Measurements are performed in a cryostat between 10 K and room temperature. Author

N92-21668*# General Electric Co., Princeton, NJ. Astro-Space Div.

THE EFFECTS OF SPACE RADIATION ON THIN FILMS OF YBa2Cu3O(7-x) **c76**

R. Herschitz, A. Bogorad, C. Bowman, S. S. Seehra, A. Mogro-Campero, and L. G. Turner (General Electric Co., Schenectady, NY.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 423-428 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

This investigation had two objectives: (1) to determine the effects of space radiation on superconductor parameters that are most important in space applications; and (2) to determine whether this effect can be simulated with Co-60 gamma rays, the standard test method for space materials. Thin films of yttrium barium copper oxide (YBCO) were formed by coevaporation of Y, BaF2, and Cu and post-annealing in wet oxygen at 850 C for 3.5 h. The substrate used was (100) silicon with an evaporated zirconia buffer layer. The samples were characterized by four point probe electrical measurements as a function of temperature. The parameters measured were the zero resistance transition temperature T(sub c) and the room temperature resistance. The samples were then exposed to Co-60 gamma-rays in air and in pure nitrogen, and to 780 keV electrons, in air. The parameters were then remeasured. The results are summarized. The results indicate little or no degradation in the parameters measured for samples exposed up to 10 Mrads of gamma-rays in nitrogen. However, complete degradation is preliminarily attributed to the high level of ozone generated in the chamber by the gamma-ray interaction with air. It can be concluded that: (1) the electron component of space radiation does not degrade the critical temperature of the YBCO films described, at least for energies around 800 keV and doses similar to those received by surface materials on spacecraft in typical remote sensing missions; and (2) for qualifying this and other superconducting materials against the space-radiation threat the standard test method used in the aerospace industry, namely, exposure to Co-60 gamma-rays in air, may require some further investigation. As a minimum, the sample must be either in vacuum or in positive nitrogen pressure. Author

N92-21669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

AN INSTRUMENT FOR SPATIAL CONDUCTIVITY MEASUREMENTS OF HIGH Tc SUPERCONDUCTING (HTSC) MATERIALS **c76**

T. VanSant *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 429-434 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

High T(sub c) Superconducting (HTSC) thin films are suggested for use in a number of aerospace applications such as an IR bolometer and as electromagnetic shielding. As part of its flight assurance role, the Materials Branch of the Goddard Space Flight Center has initiated development of an instrument capable of measuring variations in conductivity for flat samples using an eddy current testing device and an X-Y positioning table. This instrument was used to examine bulk HTSC samples. System changes that would enable characterization of thin film materials are discussed. Author

N92-21670*# Fluoramics, Inc., Upper Saddle River, NJ.

PLASTIC SUPERCONDUCTOR BEARINGS ANY SIZE-ANY SHAPE: 77 K AND UP **c76**

Franklin G. Reick *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 435-448 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

'Friction free' bearings at 77 K or higher are possible using the high T(sub c) copper oxide ceramic superconductors. The conventional method for making such bearings is to use a sintered

ceramic monolith. This puts great restraints on size, shape, and postforming machining. The material is hard and abrasive. It is possible to grind up ceramic superconductors and suspend the granules in a suitable matrix. Mechanical properties improve and are largely dependent on the binder. The Meissner effect is confined to individual grains containing electron vortices. Tracks, rails, levitation areas, and bearings can be made this way with conventional plastic molding and extruding machines or by painting. The parts are easily machined. The sacrifice is in bulk electrical conductivity. A percolating wick feed for LN2 is used to cool remote superconductors and large areas quite effectively. A hollow spheroid or cylinder of superconductor material is molded with the internal surfaces shielded by the Meissner effect. It can be thought of as the DC magnetic analog of the Faraday cage and the inside is the 'Meissner space'. It is selective. The AC fields are transmitted with minor attenuation. Particle size and distribution have a profound effect on final magnetic and electrical characteristics. Author

N92-21671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

UPCOMING PLANETARY MISSIONS AND THE APPLICABILITY OF HIGH TEMPERATURE SUPERCONDUCTOR BOLOMETERS **c76**

J. Brasunas, V. Kunde, H. Moseley, and B. Lakew (ST Systems Corp., Lanham, MD.) *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 449-458 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Planetary missions to Mars and beyond can last 11 years and longer, making impractical the use of stored cryogens. Passive radiative coolers and single-stage mechanical coolers remain possibilities. Cassini and Comet Rendezvous/Asteroid Fly-by (CRAF), both using the newly developed Mariner Mark 2 spacecraft, will be the next outer planet missions after Galileo; they are intended to provide information on the origin and evolution of the solar system. CRAF is slated for a 1994 launch. Cassini was chosen by ESA and will be launched by a Titan 4/Centaur in 1996. It will fly by Jupiter in 2000, inject an ESA-supplied probe into Titan in 2002, and take data in Saturn's orbit from 2002 to 2006. NASA/Goddard is currently developing a prototype Fourier transform spectrometer, the Composite Infrared Spectrometer (CIRS), for the Cassini mission. The baseline infrared detectors for CIRS are HgCdTe to 16 microns and Schwarz-type thermopiles from 16 to 1000 microns. The far infrared focal plane could be switched from thermopiles to high temperature superconductor (HTS) bolometers between now and 1996. An HTS bolometer could be built using the kinetic inductance effect, or the sharp resistance change at the transition. The transition-edge bolometer is more straightforward to implement, and initial efforts at NASA/Goddard are directed to that device. A working device was made and tested in early 1989. It also has somewhat elevated noise levels below 100 Hz. Upcoming efforts will center on reducing the time constant of the HTS bolometer by attempting to deposit an HTS film on a diamond substrate, and by thinning SrTiO3 substrates. Attempts will be made to improve the film quality to reduce the 1/4 noise level, and to improve the thermal isolation to increase the bolometer sensitivity. An attempt is being made to deposit good-quality HTS films on diamond films using a metal-organic chemical vapor deposition (MOCVD) technique. Author

N92-21672*# General Electric Co., Schenectady, NY.

THE EFFECT OF TEMPERATURE CYCLING TYPICAL OF LOW EARTH ORBIT SATELLITES ON THIN FILMS OF YBa2Cu3O(7-x) **c76**

A. Mogro-Campero, L. G. Turner, A. Bogorad, and R. Herschitz (General Electric Co., Princeton, NJ.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 459-463 (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 20L

Thin films of YBa2Cu3O(7-x) (YBCO) were temperature cycled to simulate conditions of a low earth orbit satellite. In one series of tests, epitaxial and polycrystalline YBCO films were cycled between temperatures of +/- 80 C in vacuum and in nitrogen for hundreds of cycles. The room temperature resistance of an epitaxial YBCO film increased by about 10 percent, but the superconducting transition temperature was unchanged. The largest changes were for a polycrystalline YBCO film on oxidized silicon with a zirconia buffer layer, for which the transition temperature decreased by 3 K. An extended test was carried out for epitaxial films. After 3200 cycles (corresponding to about 230 days in space), transition temperatures and critical current densities remained unchanged. Author

N92-21673*# Fudan Univ., Shanghai (China).

A YBCO RF-SQUID VARIABLE TEMPERATURE SUSCEPTOMETER AND ITS APPLICATIONS **c35**

Luwei Zhou, Jinwu Qiu, Xianfeng Zhang, Zhimin Tang, Yimin Cai, and Yongjia Qian *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 464-468 Sponsored in part by China National Center for Research and Development on Superconductivity, and K.C. Wong Education Foundation, Hong Kong (For primary document see N92-21605 12-24)

Avail: NTIS HC/MF A21 CSCL 14B

The Superconducting QUantum Interference Device (SQUID) susceptibility using a high-temperature radio-frequency (rf) SQUID and a normal metal pick-up coil is employed in testing weak magnetization of the sample. The magnetic moment resolution of the device is 1 x 10(exp -6) emu, and that of the susceptibility is 5 x 10(exp -6) emu/cu cm. Author

N92-21674*# United Technologies Research Center, East Hartford, CT.

STATIC AND DYNAMICAL MEISSNER FORCE FIELDS Abstract Only **c76**

B. R. Weinberger, L. Lynds, J. R. Hull, and T. M. Mulcahy (Argonne National Lab., IL.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 469 (For primary document see N92-21605 12-24)

(Contract W-31-109-eng-38)

Avail: NTIS HC/MF A21 CSCL 20L

The coupling between copper-based high temperature superconductors (HTS) and magnets is represented by a force field. Zero-field cooled experiments were performed with several forms of superconductors: 1) cold-pressed sintered cylindrical disks; 2) small particles fixed in epoxy polymers; and 3) small particles suspended in hydrocarbon waxes. Using magnets with axial field symmetries, direct spatial force measurements in the range of 0.1 to 10(exp 4) dynes were performed with an analytical balance and force constants were obtained from mechanical vibrational resonances. Force constants increase dramatically with decreasing spatial displacement. The force field displays a strong temperature dependence between 20 and 90 K and decreases exponentially with increasing distance of separation. Distinct slope changes suggest the presence of B-field and temperature-activated processes that define the forces. Hysteresis measurements indicated that the magnitude of force scales roughly with the volume fraction of HTS in composite structures. Thus, the net force resulting from the field interaction appears to arise from regions as small or smaller than the grain size and does not depend on contiguous electron transport over large areas. Results of these experiments are discussed. Author

N92-21675*# Cornell Univ., Ithaca, NY. Mechanical and Aerospace Engineering.

MAGNETIC FORCES IN HIGH-Tc SUPERCONDUCTING BEARINGS **c76**

F. C. Moon *In* NASA. Goddard Space Flight Center, AMSAHTS

1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 471 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

In September 1987, researchers at Cornell levitated a small rotor on superconducting bearings at 10,000 rpm. In April 1989, a speed of 120,000 rpm was achieved in a passive bearing with no active control. The bearing material used was YBa2Cu307. There is no evidence that the rotation speed has any significant effect on the lift force. Magnetic force measurements between a permanent rare-earth magnet and high T(sub c) superconducting material versus vertical and lateral displacements were made. A large hysteresis loop results for large displacements, while minor loops result for small displacements. These minor loops seem to give a slope proportional to the magnetic stiffness, and are probably indicative of flux pinning forces. Experiments of rotary speed versus time show a linear decay in a vacuum. Measurements of magnetic dipole over a high-T(sub c) superconducting disc of YBCO show that the lateral vibrations of levitated rotors were measured which indicates that transverse flux motion in the superconductor will create dissipation. As a result of these force measurements, an optimum shape for the superconductor bearing pads which gives good lateral and axial stability was designed. Recent force measurements on melt-quench processed superconductors indicate a substantial increase in levitation force and magnetic stiffness over free sintered materials. As a result, application of high-T(sub c) superconducting bearings are beginning to show great promise at this time. Author

N92-21676*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
PROGRESS OF RESEARCH OF HIGH-Tc SUPERCONDUCTORS Abstract Only **c76**
Shoji Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 475 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Research in the area of of high T(sub c) superconductors has made great progress in the last few years. New materials were found and the systematic investigation of these materials has contributed to understanding the mechanism of high T(sub c) superconductivity. The critical currents in thin films, bulks, and tapes increased drastically, and the origin of flux pinning will be clarified in the near future. The future of high T(sub c) superconductivity, in both the basic and applied research areas, is very optimistic. Recent activities in research of high T(sub c) superconductivity and superconductors in Japan are overviewed. Author

N92-21677*# National Aeronautics and Space Administration, Washington, DC.
PROSPECTS AND PROGRESS OF HIGH Tc SUPERCONDUCTIVITY FOR SPACE APPLICATIONS **c76**
Robert R. Romanofsky and Marty M. Sokoloski *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 477-486 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Current research in the area of high temperature superconductivity is organized around four key areas: communications and data, sensors and cryogenics, propulsion and power, and space materials technology. Recently, laser ablated YBa2Cu3O(7-x) films on LaAlO3 produced far superior RF characteristics when compared to metallic films on the same substrate. The achievement has enabled a number of unique microwave device applications, such as low insertion loss phase shifters and high-Q filters. Melt texturing and melt-quenched techniques are being used to produce bulk material with optimized magnetic properties. These yttrium-enriched materials possess enhanced flux pinning characteristics and could lead to prototype cryocooler bearings. Significant progress has also occurred in bolometer and current lead technology. Studies were conducted to evaluate the effect of high temperature superconducting materials on the performance and life of high power magnetoplasma-dynamic thrusters. Extended studies were also performed to evaluate the benefit of superconducting magnetic energy storage for LEO space station, lunar, and Mars mission applications. Author

N92-21678*# Naval Research Lab., Washington, DC.
US NAVY SUPERCONDUCTIVITY PROGRAM **c76**
Donald U. Gubser *In* NASA. Goddard Space Flight Center, AMSARTS '90: Advanced in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 487-488 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

Both the new high temperature superconductors (HTS) and the low temperature superconductors (LTS) are important components of the Navy's total plan to integrate superconductivity into field operational systems. Fundamental research is an important component of the total Navy program and focuses on the HTS materials. Power applications (ship propulsion) use LTS materials while space applications (millimeter wave electronics) use HTS materials. The Space Experiment to be conducted at NRL will involve space flight testing of HTS devices built by industry and will demonstrate the ability to engineer and space qualify these devices for systems use. Another important component of the Navy's effort is the development of Superconducting Quantum Interference Device (SQUID) magnetometers. This program will use LTS materials initially, but plans to implement HTS materials as soon as possible. Hybrid HTS/LTS systems are probable in many applications. A review of the status of the Navy's HTS materials research is given as well as an update on the Navy's development efforts in superconductivity. Author

N92-21725* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
COMPOSITE THERMAL BARRIER COATING Patent
Isidor Zaplatynsky, inventor (to NASA) 14 Jan. 1992 4 p Filed 31 Jul. 1990 Supersedes N91-13500 (29 - 5, p 632)
(NASA-Case-LEW-14999-1; US-Patent-5,080,977;
US-Patent-Appl-SN-560926; US-Patent-Class-428-432;
US-Patent-Class-428-212; US-Patent-Class-428-213;
US-Patent-Class-428-426; US-Patent-Class-428-433;
US-Patent-Class-428-469; US-Patent-Class-428-472.2) Avail: US Patent and Trademark Office CSCL 11D

A composite thermal barrier coating for a substrate is presented. The coating is comprised of a first layer that includes a ceramic material and a second layer that includes a ceramic material impregnated with glass. The glass is a ternary eutectic. The glass consists of about 14.6 weight percent Al203, about 23.3 weight percent CaO, and about 62.1 weight percent SiO2. The ceramic materials may include yttria-stabilized zirconia.
Official Gazette of the U.S. Patent and Trademark Office

N92-21744# Rolls-Royce Ltd., Derby (England).
THE SEARCH FOR NEW MATERIALS
S. C. Miller 1 Oct. 1990 9 p
(PNR-90777; ETN-92-90765) Copyright Avail: NTIS HC/MF A02

The technology of advanced materials is considered and their great potential for improving the industry's operations is stressed. Their use in avionics, structural applications to airframes and in the aeroengine scene is considered. Families of materials and their development are traced and the 747-524 combination's performance as it could be improved by the materials which will become available in about 15 years time are considered. ESA

N92-21845# Rolls-Royce Ltd., Derby (England). Composites Lab.
EVALUATION OF THE GLASS TRANSITION TEMPERATURE OF FIBRE REINFORCED POLYMER COMPOSITES USING DYNAMIC MECHANICAL ANALYSIS: SAMPLE AND INSTRUMENT CRITERIA

S. W. Hill 1 Oct. 1990 11 p
(PNR-90778; ETN-92-90766) Copyright Avail: NTIS HC/MF A03

The regulatory bodies of the aviation industry have recently introduced legislative guidelines for defining the maximum operating temperature of polymer matrix composites with reference to the glass transition temperature (T(sub g)) of the material. A greater emphasis is therefore placed upon accurate measurement of T(sub g) and having an understanding of the methods used for its measurement. The effect of variations in sample and instrument parameters in the value of T(sub g) measured by dynamic mechanical analysis is evaluated. From the results of this work, an understanding of the technique is gained and a standard test method for inclusion in specifications applied to material suppliers is generated. ESA

N92-21859# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. des Materiaux Macromoleculaires.
THE FIBER GLASS/POLYEPOXY MATRIX INTERFACE: INTRODUCING AN INTERPHASE OF CONTROLLED PROPERTIES Ph.D. Thesis [INTERFACE FIBRE DE VERRE/MATRICE POLYEPOXY: INTRODUCTION D'UNE INTERPHASE A PROPRIETES CONTROLLEES]
Carla Ahlstrom 1991 305 p In FRENCH
(ISAL-91-0040; ETN-92-90857) Avail: NTIS HC/MF A14

The interface between a polyepoxy matrix and E glass fibers submitted to various surface treatments is studied by means of two adhesion tests. A pull-out test and a microfilament fragmentation test are carried out. The glass fibers are used untreated or simply washed in a solvent. The behavior of glass fibers wrapped in an interphase of known composition and properties is compared to that of the untreated fibers. The results of the fragmentation tests are described in detail. The pull-out tests produced no results due to the strong adhesion between the polyepoxy matrix and the glass fibers. ESA

N92-21991# Technische Univ., Berlin (Germany, F.R.). Fachbereich Verkehrwesen.
CARRYING BEHAVIOR AND DIMENSIONING OF FIBER REINFORCED PRESSURE VESSELS Ph.D. Thesis [TRAGVERHALTEN UND DIMENSIONIERUNG FASERVERSTAERKTER DRUCKBEHAELTER]
Holger Voelzke 1991 117 p In GERMAN
(ETN-92-91159) Avail: NTIS HC/MF A06

The static optimal dimensioning of partially reinforced high pressure vessels is examined with regard to weight and minimum material cost design. Hemisphere is recommended as the most favorable head shape. It allows a simple dimensioning for constant wall thickness and balanced internal stress. Analytical and experimental investigations in commercial pressure gas cylinders showed the great advantages of fiber reinforcement in cylindrical containers with regard to bursting pressure increase. ESA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N92-21085# Melbourne Univ., Parkville (Australia). School of Physics.
MICRON SCALE SPECTROSCOPIC ANALYSIS OF MATERIALS
David James, Trevor Finlayson (Monash Univ., Clayton, Australia), and Steven Prawer 1991 31 p
(DE92-611968; UM-P-91/63) Avail: NTIS HC/MF A03

The goal of this proposal is the establishment of a facility which will enable complete micron scale spectroscopic analysis of any sample which can be imaged in the optical microscope. Current applications include studies of carbon fibers, diamond thin films, ceramics (zirconia and high T(sub c) superconductors), semiconductors, wood pulp, wool fibers, mineral inclusions, proteins, plant cells, polymers, fluoride glasses, and optical fibers. The range of interests crosses traditional discipline boundaries and augurs well for a truly interdisciplinary collaboration. Developments in instrumentation such as confocal imaging are planned to achieve sub-micron resolution, and advances in computer software and hardware will enable the aforementioned spectroscopies to be used to map molecular and crystalline phases on the surfaces of materials. Coupled with existing compositional microprobes (e.g., the proton microprobe) the possibilities for the development of new, powerful, hybrid imaging technologies appear to be excellent. DOE

N92-21221# Lawrence Livermore National Lab., CA.
NEW APPLICATIONS OF ACCELERATOR MASS SPECTROMETRY
J. C. Davis 25 Sep. 1991 6 p Presented at the Vacuum Design of Synchrotron Light Sources, Argonne, IL, 13-15 Nov. 1991
(Contract W-7405-eng-48)
(DE92-006900; UCRL-JC-108453; CONF-911178-1) Avail: NTIS HC/MF A02

Since its invention in the late 1970's, and reduction to near-routine practice by the mid 1980's, accelerator mass spectrometry (AMS) has become a powerful tool for archaeological and geochemical measurements in which cosmogenic isotopes such as Be-10, C-14, Al-26, Cl-36, and I-129 are used as either traçers or chronometers. The utility of such measurements is demonstrated by the fact that most accelerators having AMS capabilities have significant backlogs of samples awaiting measurement. In designing and justifying a new accelerator facility in which AMS was to be a major feature, we sought to advance the field and increase the resources available for it by two steps: (1) development of new research applications in which intentionally added isotopic labels were used rather than just naturally present ones; and (2) enhancement of spectrometer throughout, making new classes of experiments possible by greatly increasing the number of samples that could be measured in individual experiments. Results of the effort to date suggest that development of a family of very small spectrometers optimized for just tritium and/or radiocarbon will be attractive in the near future. DOE

N92-21227# Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (Germany, F.R.).
INITIATION DISTANCE AND DETONATION RADIUS [INITIIERUNBGSABSTAND UND DETONATIONSRADIUS]
Manfred Held 1991 17 p In GERMAN Presented at the 22nd ICT Combustion and Reaction Kinetics International Annual Conference, Karlsruhe, Fed. Republic of Germany, 2-5 Jul. 1991
(MBB-UA-1209-91-PUB; ETN-92-90996) Avail: NTIS HC/MF A03

The process of axial breakthrough of the detonation front is considered. The trajectories can be obtained as a function of the blasting charge radius by evaluating the temporal gradient of the axial detonation wave with the charge axis. The intersecting points yield the initiation distance as a function of the radius. These observation processes were used in tests for different stimuli, such as initiation with exploder and with shock waves. The test setups and analyses are detailed. ESA

N92-21261# Sao Paulo Univ. (Brazil). Faculdade de Filosofia, Ciencias e Letras.
POLAROGRAPHIC, SPECTROPHOTOMETRIC, AND COULOMETRIC STUDIES OF MoO4(--) IN H2SO4
R. Tokoro and M. Bertotti 1990 7 p Presented at the 7th Brazilian Symposium on Electrochemistry and Electroanalitics, Ribeirao Preto (Brazil), 8-11 Apr. 1990
(DE92-605862; INIS-BR-2820; CONF-9004235) Avail: NTIS HC/MF A02

This study characterizes the polarographic process of MoO4(sup =) in H2SO4 medium, determining which species is responsible by catalytic cycle. Spectrophotometric and coulometric studies are also described. DOE

N92-21284# Brookhaven National Lab., Upton, NY.
ELECTROLYTIC HYDROGEN-METAL INTERACTIONS
J. McBreen 1991 10 p Presented at the 180th Meeting of the Electrochemical Society, Phoenix, AZ, 13-18 Oct. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007600; BNL-46107; CONF-911047-16) Avail: NTIS HC/MF A02

The electrolyte composition and the electrodic conditions have a major effect on the entry of electrolytic hydrogen into metals. In the case of ferrous metals there is a large body of literature and various promoters have been identified. Only a few inhibitors have been found, such as organic nitriles. This paper reports the complete inhibition of the entry of hydrogen into iron by UPD Zn in concentrated alkali solutions. Less is known about the effect of electrolytes on the entry of hydrogen into palladium. The present work shows that many of the known promoters for ferrous metals actually inhibit the entry and egress of hydrogen from palladium. Permeation results on a Pd membrane in pure 0.1 M NaOH indicate that only 20 percent of the surface is used for the entry of hydrogen into the metal. In 0.1 M NaOH + 10(exp -3) M NaCN, it drops to 5 percent. The fraction of the surface used strongly depends on electrolyte purity. Impurity effects can account for the discrepant results for electrochemical hydrogen loading of Pd. DOE

N92-21285# Texas Univ., Austin.
MODEL CATALYTIC OXIDATION STUDIES USING SUPPORTED MONOMETALLIC AND HETEROBIMETALLIC OXIDES
J. G. Ekerdt 3 Feb. 1992 28 p
(Contract DE-FG05-86ER-13604)
(DE92-007702; DOE/ER-13604/17) Avail: NTIS HC/MF A03

This research program is directed toward a more fundamental understanding of the effects of catalyst composition and structure on the catalytic properties of metal oxides. Metal oxide catalysts play an important role in many reactions bearing on the chemical aspects of energy processes. Metal oxides are the catalysts for water-gas shift reactions, methanol and higher alcohol synthesis, isosynthesis, selective catalytic reduction of nitric oxides, and oxidation of hydrocarbons. A key limitation to developing insight into how oxides function in catalytic reactions is in not having precise information of the surface composition under reaction conditions. To address this problem we have prepared oxide systems that can be used to study cation-cation effects and the role of bridging (-O-) and/or terminal (=O) surface oxygen anion ligands in a systematic fashion. Since many oxide catalyst systems involve mixtures of oxides, we selected a model system that would permit us to examine the role of each cation separately and in pairwise combinations. Organometallic molybdenum and tungsten complexes were proposed for use, to prepare model systems consisting of isolated monomeric cations, isolated monometallic dimers and isolated bimetallic dimers supported on silica and alumina. The monometallic and bimetallic dimers were to be used as models of more complex mixed-oxide catalysts. Our current program was to develop the systems and use them in model oxidation reactions. DOE

N92-21286# Johns Hopkins Univ., Baltimore, MD.
INVESTIGATION OF THE PROCESSES CONTROLLING THE FLAME GENERATION OF REFRACTORY MATERIALS
J. L. Katz Jan. 1992 5 p
(Contract DE-FG02-88ER-45356)
(DE92-008189; DOE/ER-45356/7) Avail: NTIS HC/MF A01

The processes involved in the formation of mixed oxides powders were studied using the counterflow diffusion flame burner. Powders of different morphologies were obtained by varying the flame conditions (temperature, residence time) and the concentration ratio of the oxides precursors. In-situ particle size and number density were determined using dynamic light scattering and 90 degree light scattering. A thermophoretic sampling method and a larger scale powder collection device also was used to collect particles, and their size and morphology examined using transmission electron microscopy, X-ray diffraction and surface area measurement by gas absorption (BET). Our emphasis has been on TiO2SiO2, SiO2GeO2, and Al2O3TiO2. The powders had a core-mantle-like (one oxide coated by the other) at low elevations in the burner and uniform mixture at higher elevations. They form chain-like structures in a low temperature flame and spherical particles in a higher temperature flame. Nanometer sized homogeneous particles of Aluminum Titanate could be obtained using Al(CH3 sub 3) and TiCl4 as precursors both in a hydrogen fueled and a methane fueled counterflow diffusion flame burner, as well as in a hydrogen fueled parallel-flow diffusion flame burner. DOE

N92-21338# Arizona Univ., Tucson. Dept. of Chemical Engineering.
NITROGEN OXIDE ABATEMENT BY DISTRIBUTED FUEL ADDITION
J. O. L. Wendt and J. B. Mereb 2 Jan. 1991 37 p
(Contract DE-AC22-87PC-79850)
(DE92-005215; DOE/PC-79850/13) Avail: NTIS HC/MF A03

Reburning experiments are presented in which the effect of the primary flame mode is examined. The application of reburning downstream of an axial diffusion primary flame without swirl is compared to reburning results in which the primary flame is premixed. The comparison is qualitative and is intended to examine reburning under more realistic conditions of utility boilers, where premixed flames are not common. Experimental results of reburning tests using nitrogen containing reburning fuels (ammonia doped natural gas and coal) are presented. The effect of reburning fuel type and nitrogen content on nitrogenous species profiles in the reburn zone are discussed. The last section is concerned with the applications of the kinetic model to predict overall reburning effectiveness from the primary NO level and to identify configuration for low total fixed nitrogen concentration. The effects of mixing in the early stage of reburning are examined and appropriate corrections are incorporated with the kinetic model to allow the prediction of nitrogenous species concentrations in the region where mixing effects are important. An empirical correlation is used to estimate the conversion of the total fixed nitrogen in the reburn zone to NO in the final stage of reburning. The kinetic model is also applied to the testing of hypothetical fuel-rich configurations to identify kinetic limits that would prevent further reductions in nitrogenous species. DOE

N92-21386# Rome Univ. (Italy).
INTERNATIONAL SYMPOSIUM ON NEW TRENDS IN PHOTOELECTROCHEMISTRY: EXTENDED ABSTRACTS
Sep. 1991 36 p Symposium held in Altavilla Milicia (PA), Italy, 22-26 Sep. 1991
(Contract DAJA45-91-M-0269)
(AD-A244352; R/D-6759-CH-02) Avail: NTIS HC/MF A03
CSCL 09/1

At present photoelectrochemistry of semiconductors covers a wide range of border problems, is stimulating discoveries and studies of new materials, and promises interesting applications in various branches of modern technology, including energetics and control systems. This review paper discusses results of investigations carried out during the last two years at Yerevan State University. Photoelectrochemical characteristics and properties of photocathodes made of yttrium barium ceramics were investigated. Sintered by standard solid state techniques, samples with various nominal compositions were degenerative p-type semiconductors. It is shown that these low cost electrodes can be used rather well instead of metallic cathodes (platinum etc.). It is shown that the use of a number of polar semiconductors as the photoanodes in photoelectrochemical cells can lead to increasing the efficiency of conversion of solar energy to hydrogen in semiconductors characterized by great exciton transitions. GRA

N92-21393# Purdue Univ., West Lafayette, IN.
SUPER HYDRIDES Final Report, 15 Jul. 1988 - 14 Jul. 1991
Herbert C. Brown 12 Sep. 1991 21 p
(Contract DAAL03-88-K-0107)

(AD-A244816; ARO-25290.6-CH) Avail: NTIS HC/MF A03 CSCL 07/3

The last decade witnessed a major thrust in research on asymmetric reduction and the development of excellent chiral reducing agents occurred during this time. My group made a significant contribution to organic chemistry by developing B-chlorodiisopinocampheyl borane (Ipc2BCl, Aldrich-DIP-Chloride), an excellent reagent for reduction of prochiral aralkyl and alpha-hindered ketones. Apart from continuing to show the utility of DIP-Chloride in reductions, we developed several other chiral reducing agents based upon our understanding of the mechanism. Thus, we synthesized B-iso-2- ethylapopinocampheyl-9-borabicyclo(3.3.1)nonane (Eapine-Borane), B-iso-2-n-propylapopinocamphenyl- 9-borabicyclo(3.3.1)nonane (Prapine-Borane), t-butyl-iso-2-(2-(benzyloxy)ethyl)-apopinocampheylchloroborane (t-BuNopOBnzBCl), t-butyl-iso-2- ethylapopinocampheylchloroborane (t-BuEapBCl), lithium-B-iso-2-ethylapopinocampheyl- 9-borabicyclo(3.3.1) nonyl hydride (Eapine-Hybride) and B-chlorodiiso-2 ethyllapopinocampheyl borane (Eap2BCl) and demonstrated their characteristics in chiral reductions. The merits and limitations of these reagents are discussed in this final report. GRA

N92-21397# Argonne National Lab., IL.
APPLICATIONS OF SYNCHROTRON RADIATION TO CHEMICAL ENGINEERING SCIENCE
Jul. 1991 178 p Presented at the Workshop on Application of Synchrotron Radiation To Chemical Engineering Science, Argonne, IL, 22-23 Apr. 1991
(Contract W-31-109-eng-38)
(DE92-007415; ANL/APS/TM-9; CONF-9104201) Avail: NTIS HC/MF A09

This report contains extended abstracts that summarize presentations made at the Workshop on Applications of Synchrotron Radiation to Chemical Engineering Science held at Argonne National Laboratory (ANL), Argonne, IL, on April 22-23, 1991. The talks emphasized the application of techniques involving absorption fluorescence, diffraction, and reflection of synchrotron x-rays, with a focus on problems in applied chemistry and chemical engineering, as well as on the use of x-rays in topographic, tomographic, and lithographic procedures. The attendees at the workshop included experts in the field of synchrotron science; scientists and engineers from ANL, other national laboratories, industry, and universities; and graduate and undergraduate students who were enrolled in ANL educational programs at the time of the workshop. Talks in the Plenary and Overview Session described the status of and special capabilities to be offered by the Advanced Photon Source (APS), as well as strategies and opportunities for utilization of synchrotron radiation to solve science and engineering problems. Invited talks given in subsequent sessions covered the use of intense infrared, ultraviolet, and x-ray photon beams (as provided by synchrotrons) in traditional and nontraditional areas of chemical engineering research related to electrochemical and corrosion science, catalyst development and characterization, lithography and imaging techniques, and microanalysis. DOE

N92-21411# National Inst. of Standards and Technology, Gaithersburg, MD.
SPECTROSCOPY OF REACTION INTERMEDIATES IN NITRAMINE DECOMPOSITION AND COMBUSTION Final Report, 20 Apr 1988 - 19 Apr. 1991
Marilyn E. Jacox 20 Jun. 1991 25 p
(Contracts MIPR-ARO-126-88; MIPR-ARO-117-89; MIPR-ARO-120-90)
(AD-A244496; ARO-25664.11-CH) Avail: NTIS HC/MF A03 CSCL 21/2

The infrared spectra of a number of free radicals and molecular ions which are expected to be important in nitramine decomposition and combustion have been obtained in solid neon. The molecular ion studies resulted in the first infrared spectral detection of dimer ions in a non-interactive environment. The ions chosen for study are important in the lower ionosphere and in combustion and high energy processes involving carbon- and nitrogen-containing materials. Other studies used monomethylnitramine (MMN) as a model compound for elucidating the chemistry of nitramine decomposition. The infrared spectrum of MMN isolated in solid neon was obtained using a manifold designed for matrix isolation sampling of low vapor pressure materials. Supporting evidence was obtained for a mechanism recently proposed by Melius for water-catalyzed nitramine decomposition. The photodecomposition of matrix-isolated MMN was studied. Evidence was obtained supporting initial detachment of NO2 and cage recombination to form the nitrite in a solid environment. Infrared and near infrared studies of other free radicals are briefly described. GRA

N92-21436# Forbes Energy Engineering, Inc., Springfield, MA.
PULSE COMBUSTION ENGINEERING RESEARCH LABORATORY: COMBUSTION CHAMBER Annual Report, 1 Jul. 1990 - 30 Jun. 1991
F. E. Belles 30 Sep. 1991 165 p
(Contract GRI-5089-260-1816)
(PB92-116185; GRI-91/0249) Avail: NTIS HC/MF A08 CSCL 21B

A pulse combustion research laboratory for low pressure systems was put into operation to investigate and resolve, on a fundamental level, issues affecting practical applications of pulse combustion technology. In the second year of the program, a NOx data base was completed with a collection of steady-state emissions data for 13 sizes and configurations of hot water boilers covering input rates from less than 100 to over 1,000 MBtu/hr. The effects of flue-gas recirculation on emissions and the overall performance were studied. Effects of air/gas mixing on combustor performance and the effects of changing gas supply pressures were investigated. To determine the effects of radiative heat loss, both ceramic and wire-mesh bodies were inserted into the combustion chamber. A linear acoustic model was developed under a subcontract and showed that linear acoustics are capable of representing a considerable part of the underlying physics of pulse combustion. A computerized bibliographic data base on pulse combustion information is being built up. GRA

N92-21461# Argonne National Lab., IL.
OXO CHEMISTRY IN SUPERCRITICAL CARBON DIOXIDE
T. R. Krause, J. W. Rathke, and R. J. Klingler 1991 8 p Presented at the American Institute of Chemical Engineers (AIChE) Annual Meeting, Los Angeles, CA, 17-22 Nov. 1991
(Contract W-31-109-eng-38)
(DE92-004128; ANL/CP-72789; CONF-911133-9) Avail: NTIS HC/MF A02

We report an investigation of the cobalt carbonyl-catalyzed oxo process in supercritical CO2 using in situ high pressure NMR spectroscopy. The use of supercritical CO2 as the solvent medium eliminates gas-liquid mixing problems. The effect of supercritical CO2 on the oxo reaction was determined by comparing the linear to branched aldehyde yield and rate and other equilibrium processes involved in the catalytic cycle with measured values in conventional liquid solvents. DOE

N92-21571# Cornell Univ., Ithaca, NY.
REACTION AND DIFFUSION IN TURBULENT COMBUSTION
S. B. Pope 2 Oct. 1991 9 p
(Contract DE-FG02-90ER-14128)
(DE92-006684; DOE/ER-14128/1) Avail: NTIS HC/MF A02

The primary objective of the research is to use Direct Numerical Simulations (DNS) to study turbulent non-premixed combustion. In DNS, the fluid mechanical and thermochemical conservation equations are solved by an accurate numerical method, without any averaging or turbulence modeling. In principle, then, DNS could be used to study a turbulent diffusion flame, for example. In practice, however, computational limitations severely restrict the flows that can be simulated. For non-reacting flows, DNS is restricted to simple geometries and moderate Reynolds number. For reacting flows there are severe restrictions on the thermochemistry. Our approach is to use DNS to study very simple turbulent reactive flows, that contain qualitatively the same phenomena real flames.

Based on the insights and information gained, statistical models will be developed and tested. These models are then applicable to the turbulent flames of practical importance. DOE

N92-21745 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TEMPERATURE DEPENDENCE OF ULTRAVIOLET ABSORPTION CROSS-SECTIONS OF ALTERNATIVE CHLOROFLUOROETHANES. PART 2: THE 2-CHLORO-1,1,1,2-TETRAFLUORO ETHANE-HCFC-124
D. Gillotay and P. C. Simon 1991 24 p Submitted for publication
(Aeronomica-Acta-A-362-1991; ISSN-0065-3713; ETN-92-91021) Avail: Institut d'Aeronomie Spatiale de Belgique, 3 Avenue Circulaire, B-1180 Brussels, Belgium

The temperature dependent ultraviolet absorption cross sections of CF3CHFCl (HCFC 124) were measured between 170 and 230 nm, for temperatures ranging from 295 to 210 K, with uncertainties between 2 and 4 pct. These results are compared with other available sets of determinations. Temperature effects are discussed and the photodissociation coefficients, presented with their temperature dependence, are calculated. Implication of the temperature dependences on the stratospheric chemistry is discussed. Parametrical formulae are proposed to computer absorption cross section values for wavelengths and temperatures useful in modeling calculations. ESA

N92-21772# Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics.
EXPERT SYSTEM FOR NUCLIDE IDENTIFICATION AND INTERPRETATION OF GAMMA SPECTRUM ANALYSIS
P. A. Aarnio, T. T. Hakulinen, and J. T. Routti 15 Apr. 1991 15 p
(PB92-134139; TKK-F-A683; ISBN-951-22-0594-7) Avail: NTIS HC/MF A03 CSCL 07D

Radionuclide identification from a measured gamma spectrum is an iterative process, where the analyst aims to find correct nuclides by decreasing the amount of possibilities by trial and error. Although the process of identification is quite complex, it can be formulated using 'rules of thumb' combined with exact mathematical analysis. Thus, an expert system can be built, where the knowledge of a human expert is converted to explicit rules. The expert system, SHAMAN, is presented which carries out the qualitative nuclide identification and activity determination with a minimum amount of user intervention. The reasoning process is performed by an inference engine written in C-language. The system uses a data base containing over 2000 radionuclides with about 48000 gamma transitions. Spectra are provided in preprocessed format, where peak energies, intensities, and backgrounds, with respective error estimates, were calculated by a separate analysis program. GRA

N92-21780# Argonne National Lab., IL.
ELECTROCHEMICAL AND NEUTRON DIFFRACTION MEASUREMENTS OF PdD(x) CATHODES
L. Redey, K. M. Myles, F. J. Rotella, J. W. Richardson, Jr., G. P. Felcher, R. L. Hitterman, and R. Kleb 1991 11 p Presented at the 180th Meeting of the Electrochemical Society, Phoenix, AZ, 13-18 Oct. 1991
(Contract W-31-109-eng-38)
(DE92-005236; ANL/CP-73231; CONF-911047-11) Avail: NTIS HC/MF A03

Potentiometric and in-situ neutron diffraction measurements have been carried out on PdD(sub x) cathodes in LiOD-saturated D2O solution. Open-circuit potentials of the PdD(sub x) electrode after interruption of high-intensity cathodic currents (300-500 mA/cm(exp 2)) showed a more negative potential (epsilon = 1010 mV, measured against a Hg/HgO reference electrode) than that expected from the literature. The anomalous potentials were observed for about 10-20 min after current interruption at x greater than 0.7 concentrations of deuterium. This phenomenon may indicate a metastable phase of the Pd-D system, which may be detected by neutron diffraction. In-situ neutron diffraction measurements, so far, have indicated only the evolution of the known (alpha) and (beta) phases of PdD(sub x). Successful neutron diffraction measurements in electrochemical cells suggest the viability of this technique for in-situ investigations of metal-hydride battery electrodes in experiments when a heavy-water electrolyte is used to model the MH2/H2O electrode. DOE

N92-21785# Quaid-i-Azam Univ., Islamabad (Pakistan). Dept. of Chemistry.
STUDIES ON ULTRAMICROELECTRODE(S) M.S. Thesis
N. Murtaza 1991 169 p
(PB92-133586) Avail: NTIS HC/MF A08 CSCL 07D

The behavior of electrodes of different materials and of different dimensions (macro, micro, ultramicro, and ultramicroarray electrode) in solution of different concentrations of supporting electrolyte (TBAP) in acetonitrile were studied with respect to the cyclic voltammetry of ferrocene, used as probe. Conductivity of all the solutions were recorded at 20 C. When the usual reversibility criteria were used, it was found that changes in electrode potential were affected by three main parameters, i.e., radius of the electrode, scan rate for a given concentration of TBAP and concentration of TBAP. Decreasing concentration of TBAP produced resistive media and separation of anodic and cathodic peak increased due to R drop. The separation of peaks varied inversely to the radius of the electrode and least separation was found in ultramicroarray electrode which shows that it is to be preferred over other working electrodes. Diffusion coefficients were calculated for solutions containing different concentrations of TBAP. Diffusion coefficients decreased with the increase in concentrations of electrolyte. Electrochemical data were collected on superconducting ceramic YBa2Cu3O7 disc electrode but the data were not reproducible. Author

N92-21815# State Univ. of New York, Albany.
DIFFUSION THROUGH A MEMBRANE FROM A SESSILE DROPLET-LIMITING CASE OF THE LARGE DROPLET APPROXIMATION FOR SHORT TIMES Technical Report No. 12, May - Aug. 1991
H. L. Frisch 5 Aug. 1991 10 p
(Contract DAAL03-88-K-0198)
(AD-A244853; TR-12; ARO-26072.17-CH-A) Avail: NTIS HC/MF A02 CSCL 07/4

The singular perturbation problem arising in the approximate solution of diffusion from a large, neat, sessile agent droplet through a thin membrane is discussed. We obtain the zeroth order short time solution, which has a definite thickness scaling. This solution is only valid for short times. GRA

N92-21840 Pennsylvania State Univ., University Park.
IGNITION AND COMBUSTION OF SOLID FUELS UNDER HIGH-VELOCITY CROSSFLOWS Ph.D. Thesis
Taras Andrew Jarymowycz 1991 130 p
Avail: Univ. Microfilms Order No. DA9204225

The ignition and combustion of solid fuels under high-velocity crossflows were studied using comprehensive numerical and experimental analyses. In the numerical analysis, the formulation is based on the multidimensional compressible Navier-Stokes equations and species transport equations. Features of this approach include consideration of finite rate chemical kinetics and variable principles. The effects of various operating conditions on the combustion behavior of the HTPB-based solid fuel samples are treated in detail. Results indicate the detailed flame structures and flowfields associated with solid fuel combustion. The ignition processes of boron particles above a burning solid fuel were also studied by numerical solution of Lagrangian equations of motion. Boron particles are ejected from the surface of the burning fuel into a high-velocity crossflow and their trajectories are traced through the reacting flowfield. The effects of particle size on their ignition time and location are determined. Dissert. Abstr.

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N92-21073# Boston Univ., MA. Dept. of Physics.
STUDIES OF TRANSITION METAL AND OVERLAYERS DYNAMICS AND MAGNETISM BY He AND SPIN-POLARIZED METASTABLE He BEAM SPECTROSCOPIES
M. El-Batanouny 16 Jan. 1992 14 p
(Contract DE-FG02-85ER-45222)
(DE92-007544; DOE/ER-45222/6) Avail: NTIS HC/MF A03

Experimental results for the investigation of quantum delocalization of hydrogen on the Pd(111) surface; the investigation of the structural and dynamical trends in the growth of Cu overlayers on Pd(111) surface; and the investigation of the magnetic structure of the NiO(111) surface using spin-polarized metastable He beam scattering are included in this paper. Planned research is also discussed. DOE

N92-21074# Northwestern Univ., Evanston, IL.
DEPOSITION AND PROPERTIES OF NOVEL NITRIDE SUPERLATTICE COATINGS
S. A. Barnett and W. D. Sproul Dec. 1991 5 p
(Contract DE-FG02-90ER-45434)
(DE92-007548; DOE/ER-45434/1) Avail: NTIS HC/MF A01

We have demonstrated that polycrystalline TiN/NbN superlattice thin films on tool steel substrates can have hardnesses H as high as 5200 kg mm(exp -2) HV(sub 0.05) (52 Gpa). This is more than twice the hardness of polycrystalline sputtered TiN and NbN deposited using the same conditions, and matches the highest H observed for single-crystal TiN/NbN superlattices. Initial parametric studies showed that H increased with decreasing superlattice period down to 4 nm, similar to the dependence for single-crystal TiN/NbN. These results are the first indication that polycrystalline superlattices with high hardness can be deposited on practical substrates. DOE

N92-21151# Argonne National Lab., IL.
IN-SITU X RAY REFLECTIVITY STUDY ON GROWTH DYNAMICS OF SPUTTER DEPOSITED GOLD ON SILICON
R. P. Chiarello, H. K. Kim, T. Roberts, D. J. Miller, R. T. Kampwirth, K. E. Gray, and H. You Nov. 1991 7 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-006966; ANL/CP-75036; CONF-911202-50) Avail: NTIS HC/MF A02

We performed in-situ x ray reflectivity measurements to study the growth dynamics of gold sputter deposited onto silicon, using an x ray scattering chamber equipped with a faced magnetron source where the substrate is held at a right angle relative to the sputtering guns. By operating the guns at low power (1 watt) and under 20 mTorr Ar, we could control the gold deposition rate to less than 1 A/sec. The observed x ray reflectivity for gold deposited onto a silicon substrate held at room temperature may be consistent with nucleated island growth for average gold particle sizes less than 50 A. Above 50 A, the reflectivity data indicates that the gold film uniformly covers the silicon surface, and that as the film thickness is increased the gold-vacuum interface gets progressively rougher. Detailed analysis of room temperature data is in progress, as is the temperature dependence on the roughness of the gold vacuum interface. DOE

N92-21153# Argonne National Lab., IL.
VANADIUM ALLOYS FOR STRUCTURAL APPLICATIONS IN FUSION SYSTEMS: A REVIEW OF VANADIUM ALLOY MECHANICAL AND PHYSICAL PROPERTIES
B. A. Loomis and D. L. Smith 16 Dec. 1991 21 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract W-31-109-eng-38)
(DE92-006973; ANL/CP-73769; CONF-911111-33) Avail: NTIS HC/MF A03

The current knowledge is reviewed on (1) the effects of neutron irradiation on tensile strength and ductility, ductile-brittle transition temperature, creep, fatigue, and swelling of vanadium-base alloys; (2) the compatibility of vanadium-base alloys with liquid lithium, water, and helium environments; and (3) the effects of hydrogen and helium on the physical and mechanical properties of vanadium alloys that are potential candidates for structural materials applications in fusion systems. Also, physical and mechanical properties issues are identified that have not been adequately investigated in order to qualify a vanadium-base alloy for the structural material in experimental fusion devices and/or in fusion reactors. DOE

N92-21159# Northrop Corp., Hawthorne, CA. Aircraft Div.
DURABILITY AND DAMAGE TOLERANCE OF ALUMINUM CASTINGS Final Report
M. W. Ozelton, S. J. Mocarski, and P. G. Porter Oct. 1991 425 p
(Contract F33615-85-C-5015)
(AD-A245237; NOR-91-25; WL-TR-91-4111) Avail: NTIS HC/MF A18 CSCL 11/6

A durability and damage tolerance (DADT) data base for aluminum casting alloys D357-T6 and B201-T7 was developed and the applicability of ultrasonic and low frequency eddy-current NDI methods to castings was assessed. Relationships among composition, heat treatment, solidification rate, microstructure, and mechanical properties were investigated using multiple regression analyses. Strontium (silicon modifier) and silver had the most significant impact on the properties of D357-T6 and B201-T7 respectively. Constant amplitude fatigue data were used to calculate an equivalent initial flaw size for both alloys. Spectrum fatigue results for D357-T6 were used to assess the applicability of current military DADT specifications to aluminum castings. The effect of intentionally-added defects (D357-T6) and nonoptimum microstructure (D357-T6 and B201-T7) on mechanical properties was determined. Four large, complex aerospace castings were produced and tested to confirm that the property data base, which was obtained for cast plates, is applicable to aircraft applications. A D357 specification for durability and damage tolerance applications was submitted to the Society of Automotive Engineers. GRA

N92-21183# Argonne National Lab., IL.
DIFFUSE SCATTERING STUDIES AS A TOOL FOR CHARACTERIZING THE LOCAL ORDER STRUCTURE AND FOR OBTAINING PAIRWISE INTERACTION ENERGIES
J. E. Epperson, H. Chen, and J. P. Anderson (Illinois Univ., Urbana.) Jan. 1992 24 p Presented at the Minerals, Metals, and Materials Society (TMS) Annual Meeting and Exhibition, San Diego, CA, 1-5 Mar. 1992
(Contracts W-31-109-eng-38; DE-FG02-91ER-45439)
(DE92-007372; ANL/CP-75256; CONF-920305-3) Avail: NTIS HC/MF A03

Diffuse scattering is a mature method for characterizing the local order structure of alloy systems. An extension of such structural investigations, for alloys at equilibrium, allows one to obtain pairwise interaction energies. Having experimental pairwise interaction energies for the various coordination shells offers one the potential for more realistic Monte Carlo modelling of alloy systems as they relax toward equilibrium. The diffuse scattering method and the recovery of the interaction energies are reviewed and some preliminary results are used to demonstrate the kinetic Ising modelling technique. DOE

N92-21314 British Aerospace Public Ltd. Co., Preston (England).
EVALUATION OF 2090 ALUMINIUM LITHIUM ALLOY SHEET SUPPLIED BY ALCOA
A. Schofield and D. R. Mayo Nov. 1989 28 p
(BAe/WMD/RP/RES/MET/004041; ETN-92-91049) Copyright Avail: Defence Research Information Centre, Kentigern House, Glasgow G2 8EX, Scotland

The results of the further assessment of aluminum lithium 2090 sheet supplied by Alcoa are detailed. Although anisotropic,

high tensile properties have been observed when 2090, in both T3E27 and T3E28 as-received conditions, is artificially aged to a T8 condition; resultant plane stress fracture toughness values are considered to be unacceptably low. The formability, which is considered to be moderate in both of the as-received conditions, was seen to be improved when 2090 sheet is formed in the freshly solution treated condition. Subsequent tensile properties following artificial aging to T62 condition are significantly lower than those for 2090 T8 and also, in terms of tensile strength, lower than the 8090 T62 sheet. The density reduction of 2090 alloy compared to conventional aluminum alloys was determined to be approximately 6 percent and this compares to an approximate reduction of 9 percent exhibited by the 8090 aluminum lithium alloy. ESA

N92-21321# Pacific Northwest Lab., Richland, WA.
THE OXIDATION BEHAVIOR OF TUNGSTEN AND GERMANIUM ALLOYED MOLYBDENUM DISILICIDE COATINGS
Andrew Mueller, Ge Wang, Robert A. Rapp, Edward L. Courtright, and T. Kircher (Naval Air Development Center, Warminster, PA.) Nov. 1991 29 p Presented at the High Temperature Structural Silicides Workshop, Gaithersburg, MD, 4-6 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006509; PNL-SA-20049; CONF-9111115-3) Avail: NTIS HC/MF A03

A two-step coating process was used to produce a (Mo,W)(Si,Ge)2 coating on niobium. After exposure to high temperatures, a lower silicide layer forms underneath and is effective in arresting cracks. The oxidation weight-gain kinetics are parabolic following an initial transient period. Test coupons coated with (Mo,W)(Si,Ge)2 passed 200 one-hour cycles at 1370 C and 60 one-hour cycles at 1540 C. These results, along with evidence of a thick protective glass layer, suggest that the germanium additions help cyclic oxidation resistance. The beneficial effects of the tungsten include the formation of microvoids, which provides a lower effective elastic modulus, and mechanical strengthening. No accelerated low temperature or 'pest' oxidation was observed in the temperature range between 500-700 C. Thus, a (Mo,W)(Si,Ge) multicomponent silicide coating offers significant promise for the protection of Nb-base alloys exposed to cyclic oxidizing environments over a broad range of temperatures. DOE

N92-21340# Lawrence Livermore National Lab., CA.
THE INDENTATION AND SCRAPING OF A METAL SURFACE: A MOLECULAR DYNAMICS STUDY
J. Belak and I. F. Stowers Oct. 1991 12 p Presented at the North American Treaty Organization (NATO) Advanced Study Institute (ASI) Meeting, Braunlage (Germany), 29 Jul. - 9 Aug. 1991
(Contract W-7405-eng-48)
(DE92-007349; UCRL-JC-108140; CONF-9107181-2) Avail: NTIS HC/MF A03

The molecular dynamics computer simulation method is used to study the indentation and scraping of a clean metal surface by a hard diamond tool. Both two and three dimensional models are considered. The embedded atom method is used to represent a metallic work material. To make connection with macroscopic continuum models, we calculate the stress field from the atomistic computer experiment. The agreement is excellent during the initial elastic indentation. However, the onset of plastic deformation occurs at a much higher yield stress in the atomistic simulations. This enhanced hardness, with shallow indentations, corresponds to the theoretical yield stress required to create dislocations and leads to a dramatic increase in specific cutting energy for small depths of cut. Remarkably, the range of plastic deformation in our three dimensional simulations is only few lattice spacings, unlike the several hundred lattice spacings dislocations readily propagate in our two dimensional simulations. This suggests that dislocations are not a very efficient mechanism for accommodating strain at this nanometer length scale in three dimensions. DOE

N92-21346# Naval Postgraduate School, Monterey, CA.
A STUDY OF THE MICROSTRUCTURAL BASIS FOR THE STRENGTH AND TOUGHNESS PROPERTIES OF AS-QUENCHED AND QUENCHED AND TEMPERED HIGH COPPER HSLA-100 STEEL M.S. Thesis
Harvey A. Winters Dec. 1991 78 p
(AD-A245151) Avail: NTIS HC/MF A05 CSCL 11/6

This report discusses a program for the use of high copper HSLA-100 steel as a replacement for HY-130 in ship construction. The characterization of the microstructure of this highly weldable high copper HSLA-100 steel is extremely important to this program. In the present work, optical, scanning, scanning electron and transmission electron microscopy were employed to analyze and characterize the microstructural basis for the mechanical properties off as-quenched and quenched and tempered high copper HSLA-100 steel in form of 19.05 mm plate. The as-quenched and samples aged at 538 and 621 C were examined in great detail. In the as-quenched condition the microstructure consisted of small packets of highly dislocated lath martensite containing autotempered iron carbides with small amounts of retained austenite present as thin films (200 to 300 A in width) at lath boundaries. The best combination of strength and toughness occurred in the sample aged at 538 C. Contributing to these desirable characteristics was the recovery of the dislocation substructures, the precipitation of coherent BBC copper precipitates (12 to 20 A in size) further precipitation (FeM)3C. GRA

N92-21406# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.
THE FABRICATION AND TESTING OF A SiCw/7050 ALUMINUM ALLOY COMPOSITE
F. Chartrand, R. T. Holt, G. LEsperance, and R. Allem 29 Aug. 1991 45 p
(NRC-LTR-ST-1766; CTN-92-60409) Avail: NTIS HC/MF A03

The results of an investigation of a metal matrix composite (MMC) consisting of the aluminum alloy 7050 reinforced with 5 pct. silicon carbide whiskers (beta type) are presented. The experimental work consisted of the preparation of the MMC by a powder metallurgy technique followed by hot isostatic pressing (HIPing). The procedures for blending the reinforcement and the aluminum powder and for canning before HIPing are described. The report presents the results of the uniaxial tensile and rotating-bending fatigue tests performed on specimens of both the composite and the unreinforced alloy after a typical overaging heat treatment to evaluate the effect of the reinforcement on the mechanical properties. The mechanical properties of these composites were inferior both to those of unreinforced wrought 7050 alloy and to the unreinforced powder processed alloy. The main problems were thought to be due to a number of factors including nonuniform distribution (and clustering) of the whiskers, poor bonding between whisker and matrix, and limited strength of the matrix due to the substantial oxide film on the aluminum powder particles. A number of recommendations to overcome these problems were made. Author (CISTI)

N92-21453# Nova Scotia Research Foundation Corp., Dartmouth.
EFFECT OF HIGH ENERGY BEAM SURFACE MODIFICATIONS ON FATIGUE AND CORROSION BEHAVIOR OF METALS: A CRITICAL REVIEW
T. Betancourt Apr. 1991 66 p Sponsored by Defence Research Establishment Atlantic
(DREA-CR-91-418; CTN-92-60447) Avail: NTIS HC/MF A04

This is a critical review of the research published during the last five years on the effects of high power beam surface modification techniques on corrosion wear and fatigue properties of modified materials. In general terms, highly adherent surface alloys were produced on irons, steels, stainless steels, Ti-base alloys, Cu alloys, and Al alloys using either ion, electron, or laser beams. Many surface alloys produced by ion, electron, and laser beams, under favorable conditions of treatment, offer better resistance to corrosion and/or wear than the original materials. There are many process variables, however, that influence the

properties of modified layers. This makes the process design difficult. There were attempts made to construct surface treatment maps that would relate major process variables and properties of treated surfaces. The surface treatment maps were developed for a limited number of alloys. Author (CISTI)

N92-21577# Oak Ridge National Lab., TN.
MICROSTRUCTURAL FEATURES AND SHAPE-MEMORY CHARACTERISTICS OF MELT-SPUN Ni-Al-Fe-B RIBBONS
C. T. Liu, C. J. Sparks, J. A. Horton, E. P. George, C. A. Carmichael, Ming-Yuan Kao, and H. Kunsmann 10 Dec. 1991 8 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006842; CONF-911202-40) Avail: NTIS HC/MF A02

This paper summarizes our recent study of NiAl+Fe+B alloy ribbons containing 4 to 20 at. pct. Fe and doped with 300 wt ppm B. Alloy ribbons were successfully fabricated by rapid solidification via melt spinning. The alloys with greater than 8 pct. Fe and less than 34 pct. Al-equivalent (=Al pct.+(Fe pct.)/2) showed the best bend ductility at room temperature. The ribbons exhibited a reversible martensite (body centered orthorombic structure) to B2 transformation as evidenced by DSC, X ray and TEM studies. The shape memory effect, as characterized by measuring the recovery of bend angles with temperature, is sensitive to alloy composition, with the best recovery observed in SMA015 (B-doped Ni-27 pct. Al-14 pct. Fe). Annealing at 600 C causes aging embrittlement; in particular, in alloys containing less than or = 12 pct. Fe. DOE

N92-21716# Oak Ridge National Lab., TN.
HIGH-STRENGTH AUSTENITIC STAINLESS STEEL TUBING
R. W. Swindeman and P. J. Maziasz 1991 18 p Presented at the 7th International Conference on Pressure Vessel Technology (ICPVT), Dusseldrof, Fed. Republic of Germany, 31 May - 5 Jun. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005160; CONF-9105254-2) Avail: NTIS HC/MF A03

Developmental steels were investigated that were basically 14 percent Cr, 16 percent Ni, 2 percent Mo-Fe with V, Ti, and Nb additions. Commercial steels of current interest include Esshete 1250, 17-14CuMo, Sumitomo St3Cu (Trademark), and Sandvik 12R72HV (trademark), which is similar to Din 1.4970. The investigation included fabricability, creep- and stress-rupture strength, and exploratory tests regarding creep-crack growth, fatigue, and weldability. Testing temperatures were in the range of 600 to 800 C, and times extended to 50,000 h. Excellent strength and ductility were observed under all loading conditions. High creep strength was due to the formation of an ultrafine precipitate distribution on dislocations produced by warm or cold work. Microstructural examination indicated that the alloys were resistant to creep cavity formation, and microstructures were stable for long times. DOE

N92-21776# Rensselaer Polytechnic Inst., Troy, NY. Dept. of Materials Engineering.
THE EFFECT OF FLOW RATES ON THE LOCALIZED CORROSION BEHAVIOR OF 304 STAINLESS STEEL IN OZONATED 0.5N NaCl
B. E. Brown, H. H. Lu, and D. J. Duquette 15 Dec. 1991 24 p
(Contract N00014-90-J-1439)
(AD-A244393) Avail: NTIS HC/MF A03 CSCL 11/6

The effect of flow on 304 stainless steel in a solution of 0.5 Normal NaCl containing 0, 0.02, and 1.2 mg/liter dissolved ozone was studied at room temperature. Flow rates ranging from 0.3 to 2.0 m/s were simulated by the use of a rotating cylinder electrode. Corrosion potentials and net current densities were measured and values of breakdown and repassivation potentials were derived from cyclic polarization curves. It was found that the transition from laminar to turbulent flow for this system occurs between 0.25 and 0.35 m/s, based on the inverse relationship observed between the breakdown and repassivation potential, as well as the changes in the net current density. Under laminar flow conditions, increasing velocity shifted the repassivation potential in the active direction due to an increase in the driving force for pitting which resulted from the stabilization of the passive film; this stabilization was also reflected by an increase in the breakdown potential in the noble direction. Values of the net current density decreased with increasing velocity in this regime, due to a decrease in the diffusion boundary layer at the alloy surface. High ozone concentrations further deceased the magnitude of the net current density due to the limiting current density of ozone increasing with concentration. Under turbulent flow conditions, increased velocity caused the net current density to stabilize in deaerated and low ozone concentration solutions. GRA

N92-21837# Lake Shore Cryotronics, Inc., Westerville, OH.
THIN FILMS OF RHODIUM-IRON ALLOYS FOR WIDE RANGE THERMOMETRY: SBIR PHASE 2 FINAL REPORT AND PHASE 3 PROGRESS REPORT
D. S. Holmes and P. R. Swinehart 31 May 1991 103 p
(Grant NSF ISI-87-13503)
(PB92-122910; NSF/ISI-91007) Avail: NTIS HC/MF A06
CSCL 11F

The primary objective was to develop a process for fabricating small, thin film Rh-Fe temperature sensors with thermometric characteristics similar to wire wound sensors. A new deposition system was constructed to allow sputter deposition of rhodium-iron alloys under high vacuum conditions. Films were deposited with the substrate temperatures between 300 and 1400 K. The best films were deposited in the range of 1100 to 1300 K and contained grains with few defects and of diameter about equal to the film thickness. The Rh-Fe films were patterned and mounted in a standard canister package. The resistance versus temperature characteristics of several thermometers were measured. The specific resistivity of the best of the resulting thin film thermometers was within a factor of two of that measured on typical commercially available wire wound Rh-Fe thermometers. The best thermometers were reproducible to within about 10 mK across the 1.4 to 325 K calibration range. Author

N92-21858 Minnesota Univ., Minneapolis.
MICROSTRUCTURE OF MARTENSITE Ph.D. Thesis
Kaushik Bhattacharya 1991 120 p
Avail: Univ. Microfilms Order No. DA9202800

The fine scale microstructure that is observed in crystalline solids that undergo the martensitic phase transformation is studied. Martensitic phase transformation is a temperature induced, first order, diffusionless phase transformation that involves a change of crystal structure. Many important properties of these materials, including the shape memory effect, are influenced by the kind of microstructure that the material can form. The role is examined that the lattice parameters of the material play in determining the microstructure and thereby, the macroscopic properties. A continuum model based on nonlinear thermoelasticity is used to model these materials. It is based on the view that the fine scale microstructure arises as the material tries to minimize its stored bulk energy under fixed boundary condition. First, it is shown that only very special materials, those whose lattice parameters satisfy some rather strict conditions can form a certain wedge-like microstructure that is commonly seen in shape memory alloys. Second, necessary and sufficient conditions on the lattice parameters for self-accomodation are derived. A geometrically linear version of the continuum theory that is used in the literature is examined. Dissert. Abstr.

N92-21310*# New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.
MODEL OF THE FRICTIONAL HEATING OF INCONEL 718 AND TITANIUM (Ti-6Al-4V) IN HELIUM Final Report
Christopher T. Skowlund *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N92-21106# Rensselaer Polytechnic Inst., Troy, NY. Dept. of Materials Engineering.

MECHANISM OF MECHANICAL FATIGUE OF FUSED SILICA

M. Tomozawa Jan. 1992 3 p

(Contract DE-FG02-85ER-45217)

(DE92-007536; DOE/ER-45217/6) Avail: NTIS HC/MF A01

This report discusses work on the fatigue of fused silica. Topics covered include: the effect of residual water in silica glass on static fatigue; strengthening of abraded silica glass by hydrothermal treatment; fatigue-resistant coating of silicon oxide glass; and water entry into silica glass during slow crack growth. DOE

N92-21143# Lawrence Livermore National Lab., CA.

SHOCK-INDUCED MARTENSITIC TRANSFORMATION OF HIGHLY ORDERED GRAPHITE

D. J. Erskine and W. J. Nellis 10 Sep. 1991 2 p Presented at the 1991 American Physical Society (APS) Conference on Shock Compression of Condensed Matter, Williamsburg, VA, 17-20 Jul. 1991

(Contract W-7405-eng-48)

(DE92-006885; UCRL-JC-105756; CONF-9107105-56) Avail: NTIS HC/MF A01

We have measured wave profiles in highly ordered pyrolytic graphite shocked normal to the basal plane. For graphite with sufficient orientational order a martensitic transformation is observed with a transition onset pressure near 20 GPa. The two-wave structure of the transition wave profile is overdriven above 40 GPa. DOE

N92-21167# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.

POINT DEFECT EFFECTS ON HOT CORROSION OF ZIRCONIA-BASED COATINGS Annual Report, Jan. 1991 - Jan. 1992

R. Reidy and G. Simkovich 16 Jan. 1992 22 p

(Contract N00014-91-J-1528)

(AD-A245202) Avail: NTIS HC/MF A03 CSCL 11/3

Thermal barrier coatings are vulnerable to certain types of hot corrosion: sulfidation and vanadic attack. Stabilized zirconia, an often used thermal barrier coating, is degraded by dissolution of the stabilizing component (e.g., yttrium oxides). To obtain the dissolution of the stabilizing components, mass transport in the coating must occur. The presence of point defects in a crystalline solid greatly affect the transport properties in that solid. The nature and concentration of these defects can be altered which, in turn, can impart large changes in the transport properties of a material (e.g., ionic conductivity and diffusion). In this study, we are determining the defect structure of yttria and ceria-stabilized zirconium oxides. Using electrical conductivity measurements, the activation energies of yttria-stabilized zirconia have been examined as a function of grain size and composition. GRA

N92-21226# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.

FABRICATION, PHASE TRANSFORMATION STUDIES AND CHARACTERIZATION OF SiC-AlN-Al2OC CERAMICS

A. V. Virkar 12 Jan. 1992 11 p

(Contract DE-FG02-87ER-45286)

(DE92-007540; DOE/ER-45286/5) Avail: NTIS HC/MF A03

SiC and AlN are two of the important high temperature structural ceramics. AlN and the 2H polytype of SiC are isostructural. Prior work has shown that they form an extension solid solution at temperatures greater than or equal to 2000 C. At lower temperatures, the solid solution can undergo phase separation. Additionally, Al2OC is also isostructural and can form extensive solid solutions with SiC and AlN. The formation of solid solutions in such refractory materials as well as the tendency to undergo diffusional phase transformations suggests that a potential exists to improve properties through alloying. The principal objective of the proposed work is to examine phase relations, phase transformations, the resulting precipitate morphologies and their influence on mechanical properties of SiC-AlN-Al2OC ceramics. Formation of modulated structures have been documented in SiC-AlN ceramics in our work. It has been shown that modulations occur along directions other than the (0001) direction and this results in the formation of a tweed type of a microstructure. In the AlN-Al2OC system, the occurrence of cellular precipitates as well as coherent, disc-shaped precipitates has been observed. During the past year, work has progressed in the following areas: (1) Phase separation in SiC-AlN system: The effect of coherency strain energy on the precipitate morphology. (2) High temperature creep of SiC-AlN ceramics containing modulated structures and SiC-Al2OC ceramics. (3) Fabrication and characterization of damage-resistant SiC-AlN ceramics. Three manuscripts have been submitted for publication. DOE

N92-21364# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

RING OPENING METATHESIS POLYMERIZATION Final Report, 1 Jan. 1989 - 31 Jan. 1992

Richard R. Schrock 15 Jan. 1992 6 p

(Contract N00014-89-J-1542)

(AD-A244693) Avail: NTIS HC/MF A02 CSCL 07/6

The central theme of this research is ring opening metathesis polymerization of norbornenes and substituted norbornadienes by well characterized imido alkylidene catalysts of the type M(CHR)(NR')(OR'')2 (where R, R', and R are some alkyl or aryl groups), or most recently alkylidyne alkylidene rhenium catalysts of the type Re(CHR)(CR')(OR'')2. Initially we focused on developing catalysts that would tolerate functionalities (such as carbonyl groups). The findings concerning the polymerization of 2,3-bistrifluoromethyl norbornadiene suggested that the polymer was virtually all trans and tactic. It is now believed to be syndiotactic. Such materials are highly polarizable above Tg(200 C). A significant fraction of the present effort is being expended toward understanding how this stereoselectivity arises and how it can be controlled by changing the nature of the catalyst. GRA

N92-21570# Oak Ridge National Lab., TN.

HIGH TEMPERATURE MATERIALS LABORATORY ANNUAL REPORT NO. 4, OCTOBER 1990 - SEPTEMBER 1991

V. J. Tennery and F. M. Foust Dec. 1991 77 p

(Contract DE-AC05-84OR-21400)

(DE92-006651; ORNL/TM-12023) Avail: NTIS HC/MF A05

The High Temperature Materials Laboratory has completed its fourth year of operation as a designated Department of Energy User Facility at the Oak Ridge National Laboratory. Growth of the user program is evidenced by the number of outside institutions who have executed user agreements since the facility began operation in 1987. A total of 118 nonproprietary agreements (62 university and 56 industry) and 28 proprietary agreements (2 university, 26 industry) are now in effect. Five other government facilities have also participated in the user program. Sixty-five nonproprietary research proposals (38 from university, 26 from industry, and 1 other government facility) and four proprietary proposals were considered during this reporting period. Research projects active in FY 1991 are summarized. DOE

N92-21574# Sandia National Labs., Albuquerque, NM.

POLYMER FILM CHARACTERIZATION USING QUARTZ RESONATORS

S. J. Martin and G. C. Frye 1991 6 p Presented at the IEEE Ultrasonics Symposium, Lake Buena Vista, FL, 8-11 Dec. 1991

(Contract DE-AC04-76DP-00789)

(DE92-006803; SAND-91-1319C; CONF-911220-2) Avail: NTIS HC/MF A02

In this paper we consider the dynamic behavior and the electrical response of a thickness-shear mode resonator with a polymer film of a few microns thickness coating one face. With glassy polymers (G' approx. 10(exp 10) dyne/sq cm), this film

moves synchronously with the oscillating resonator surface; with rubbery polymers (G' approx. 10(exp 7) dyne/sq cm), the upper portions of the film lay behind the driven resonator/film interface, causing shear deformation of the film. Interesting dynamic film behavior results, notably a film resonance when the acoustic phase shift across the film is an odd multiple of pi/2. This dynamic behavior influences the electrical response of the resonator due to the coupling between shear displacement and the electric field in the piezoelectric quartz. An equivalent circuit model is derived that relates the near-resonant electrical characteristics of a polymer-coated resonator to the film properties. Measurements made on a polyisobutylene-coated resonator were interpreted with the model to obtain the film's shear storage and the loss moduli (G', G''), giving good agreement with previously reported values. In addition, changes in resonant frequency and damping observed at film resonance agree with model predictions. DOE

N92-21578# Oak Ridge National Lab., TN.
OPTICAL AND INFRARED SPECTROSCOPY OF LASER IRRADIATED Bi IMPLANTED SiO2 GLASSES
R. H. Magruder, III, D. O. Henderson, S. H. Morgan, and R. A. Zuhr 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006854; CONF-911202-41) Avail: NTIS HC/MF A01

Recently glasses containing polarizable ions have received considerable attention because of the possibility of their use as fast photonic switching media. While the nonlinear index of refraction n(sub 2) of these glasses is not as large as with other materials, they in general possess higher figure of merit because of low absorption and speed of response. Multicomponent glasses containing Bi have been suggested to be one of the more promising candidate systems. However multicomponent systems are not always compatible with present technology used to form waveguides. Another way to form a Bi containing glass is by ion implantation. Ion implantation offers an established technique to create materials that cannot be obtained by conventional processes due to chemical and/or thermodynamical constraints. It offers concentration and depth control not possible with other techniques and is a method that is compatible with present waveguide and semiconductor processing technology. In this paper we report the effects of 5eV laser irradiation on the optical and infrared properties of Bi-implanted high purity SiO2. The bleaching phenomenon observed may be useful as a photonic memory material as well as a method to change the nonlinear index of refraction of these materials. DOE

N92-21579*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
LUBRICATION OF SPACE SYSTEMS: CHALLENGES AND POTENTIAL SOLUTIONS
Robert L. Fusaro 1992 23 p Presented at the International Conference on Metallurgical Coatings and Thin Films, San Diego, CA, 6-10 Apr. 1991; sponsored by the American Vacuum Society
(NASA-TM-105560; E-6864; NAS 1.15:105560) Avail: NTIS HC/MF A03 CSCL 11C

Future space missions will all require advanced mechanical moving components which will require wear protection and lubrication. The tribology practices used today are primarily based upon a technology base that is more than 20 years old. This paper will discuss NASA's future space missions and some of the mechanism tribology challenges that will be encountered. Potential solutions to these challenges using coatings technology will be assessed. Author

N92-21711* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SEMI-INTERPENETRATING POLYMER NETWORK FOR TOUGHER AND MORE MICROCRACKING RESISTANT HIGH TEMPERATURE POLYMERS Patent
Ruth H. Pater, inventor (to NASA) 24 Mar. 1992 13 p Filed 26 Jan. 1989 Supersedes N89-25334 (27 - 19, p 2698)
(NASA-Case-LAR-13925-1; US-Patent-5,098,961; US-Patent-Appl-SN-301925; US-Patent-Class-525-422; US-Patent-Class-524-495; US-Patent-Class-525-432; US-Patent-Class-525-903; Int-Patent-Class-C08L-79/08; Int-Patent-Class-C08J-5/08; Int-Patent-Class-C08K-3/04) Avail: US Patent and Trademark Office CSCL 11C

This invention is a semi-interpenetrating polymer network which includes a high performance thermosetting polyimide having a nadic end group acting as a crosslinking site and a high performance linear thermoplastic polyimide. An improved high temperature matrix resin is provided which is capable of performing at 316 C in air for several hundreds of hours. This resin has significantly improved toughness and microcracking resistance, excellent processability and mechanical performance, and cost effectiveness.
Official Gazette of the U.S. Patent and Trademark Office

N92-21722# Lawrence Livermore National Lab., CA.
REPAIR OF HIGH PERFORMANCE MULTILAYER COATINGS
D. P. Gaines, N. M. Ceglio, S. P. Vernon, and M. Krumrey (Physikalisch-Technische Bundesanstalt, Berlin, Germany, F.R.) Jul. 1991 13 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-007339; UCRL-JC-108297; CONF-9107115-67) Avail: NTIS HC/MF A03

Fabrication and environmental damage issues may require that the multilayer x-ray reflection coatings used in soft x-ray projection lithography be replaced or repaired. Two repair strategies were investigated. The first was to overcoat defective multilayers with a new multilayer. The feasibility of this approach was demonstrated by depositing high reflectivity (61 percent at 130 Angstrom) molybdenum silicon (Mo/Si) multilayers onto fused silica figured optics that had already been coated with a Mo/Si multilayer. Because some types of damage mechanisms and fabrication errors are not repairable by this method, a second method of repair was investigated. The multilayer was stripped from the optical substrate by etching a release layer which was deposited onto the substrate beneath the multilayer. The release layer consisted of a 1000 Angstrom aluminum film deposited by ion beam sputtering or by electron beam evaporation, with a 300 Angstrom SiO2 protective overcoat. The substrates were superpolished zerodur optical flats. The normal incidence x-ray reflectivity of multilayers deposited on these aluminized substrates was degraded, presumably due to the roughness of the aluminum films. Multilayers, and the underlying release layers, have been removed without damaging the substrates. DOE

N92-21755# Ohio State Univ., Columbus.
DERIVATIVES OF BORANES, POSSIBLE METAL AND BORIDE AND BORON NITRIDE PRECURSORS Final Report, 1 Aug. 1988 - 31 Jul. 1991
Sheldon G. Shore 27 Sep. 1991 20 p
(Contract DAAL03-88-K-0176)
(AD-A244813; ARO-26145.11-CH) Avail: NTIS HC/MF A03 CSCL 07/3

The synthesis of B10H14 from B5H9 was modified to facilitate large scale production. Reductions of boranes by alkali and lanthanide metals were studied. Depending upon the reaction conditions chosen, the anions (BH3)(--), (B2H6)(--), and (B3H8)(-) were produced. A simple procedure was developed for the preparation of the solvent free salts M(B3H8) (M = K, Rb, Cs). Borohydrides of the divalent lanthanides Yb, Eu were synthesized, structurally characterized, and then converted to lanthanide borides YbB4 and EuB6. New procedures for the preparation of high purity boron nitride as powders and coatings were developed. An essentially instantaneous reaction between B3N3H3Cl3 and Cs can be initiated at temperatures as low as 135 C to produce very finely divided amorphous boron nitride. The amorphous BN is converted to the turbostratic form by heating it at 1100 C. H3NBH2Cl in solution form can be applied to a surface. Heating to 1100 C in vacuum produces a coating of turbostratic BN.
GRA

N92-21789# Eclipse, Inc., Rockford, IL. Combustion Div.
CERAMIC SINGLE ENDED RECUPERATIVE RADIANT TUBE, PHASE 1 Final Report, Nov. 1986 - Dec. 1989
Shyam N. Singh and Lunne M. Gorski Jan. 1990 311 p
(Contract GRI-5086-234-1310)
(PB91-222554; GRI-90/0327-Phase-1) Avail: NTIS HC/MF A14 CSCL 11C

A silicon carbide single-ended recuperative radiant tube (SER) combustion system was developed to compete against electric heating elements which can operate at higher heat fluxes and furnace temperatures than metallic gas-fired systems. The silicon carbide SER system resulted in 50 percent or higher thermal efficiency depending upon the operating temperature and heat flux. Two industrial batch-type heat-treating furnaces with process temperatures of 1450 to 1750 F were retrofitted with 3-1/4 in. silicon carbide SERs operating at heat fluxes of 100 to 150 Btu/hr/in2. The SERs replaced conventional straight-through radiant tube combustion systems with efficiences less than 30 percent and limited to heat fluxes less than 55 Btu/hr/sq in. After a year of operation, the hosts reported a 35 percent increase in furnace productivity and 40 to 50 percent fuel savings. Experience indicated that reaction-bonded silicon carbide radiant tube applications should be limited to a 2200 F chamber temperature and a heat flux of 200 Btu/hr/in2. Beyond this, tube life is unpredictable. The SERs may be applied to process temperatures of 2300 F, provided the heat flux is lowered to 150 Btu/hr/in2. NOx levels of 150 to 200 ppm have been recorded for a heat flux of 200 Btu/hr/in2 and 1800 to 2200 F chamber temperatures. Investigations are under way to further reduce NOx formation in high temperature applications. Author

N92-21793# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Polymer Technology.
POLYCAPROLACTONE: MANUFACTURE, PROPERTIES AND APPLICATIONS
R. Miettinen 1990 29 p
(PB92-136514; ISBN-951-22-0451-7; Poly-Tech-Pub-Ser-8B)
Avail: NTIS HC/MF A03 CSCL 11C

Polycaprolactones are highly crystalline aliphatic polyesters that do not belong to the class of commodity plastics. They are specialized polymers for advanced applications. Depending on molecular weight, many kinds of interesting applications are mentioned. The main special features of polycaprolactones are biodegradability when in contact with soil, low and sharp melting points, nontoxicity, exceptionally broad miscibility with a wide range of polymers, and good adhesion to many materials. The main limiting property is its poor temperature resistance. Its melting point is 65 C, and the glass transition temperature is -70 C. These properties have made polycaprolactones versatile polymer modifiers. At least two manufacturers are known to exist. Union Carbide Co. introduced the material in 1969 with the trade name TONE. The only European company in the field is Interox Chemicals Ltd.; it sells its polycaprolactones under the trade name CAPA. Author

N92-21794# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Polymer Technology.
HYDROXY BUTYRIC ACIDS: PROPERTIES AND POLYMERIZATION
J. Ahlgren 1991 64 p
(PB92-136522; ISBN-951-22-0524-6; Poly-Tech-Pub-Ser-9) Avail: NTIS HC/MF A04 CSCL 11C

Hydroxybutyric acids and their lactones are discussed. Their properties, polymerization methods, and polymers are reviewed. There is a special interest in poly (Beta-hydroxybutyrate), because it is a naturally occurring, optically active, highly crystalline and biodegradable polyester. It can already be produced by fermentation, and synthetic methods to produce it by polymerization are studied extensively at the moment. Poly (Beta-hydroxybutyrate) can be obtained by polymerizing Beta-butyrolactone in the presence of initiators. Stereoselective initiators are especially interesting, because when using them, a substance similar to naturally occuring polymer is obtained. Stereoselective initiators are not yet effective enough to produce isotactic and enantiomerically pure polymer in high yields. Research in this area has been extensive during the last few years and is still going on. Author

N92-21806# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Polymer Technology.
POLYMERIZATION OF ITACONIC ACID
J. Ahlgren 1990 41 p
(PB92-136506; Poly-Tech-Pub-Ser-8A) Avail: NTIS HC/MF A03 CSCL 11C

Itaconic acid has various uses in chain copolymerization reactions, because of its two carboxylic groups and relatively good reactivity with different comonomers. As an unsaturated dicarboxylic acid, it also has applications in grafting reactions and polycondensation reactions. What makes itaconic acid really interesting as a polymerizable monomer, is the possibility of manufacturing it from sugars by fermentation processes. Thus, the monomer production is independent of oil production. Author

N92-21841# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Polymer Technology.
FLEXIBLE POLYMERIZATION APPARATUS FOR HOMO-, CO- AND TERPOLYMERIZATION OF OLEFINS
J. Koivumaeki 1991 24 p
(PB92-136530; ISBN-951-22-0728-1; Poly-Tech-Pub-Ser-10)
Avail: NTIS HC/MF A03 CSCL 11C

The purpose is to introduce the polymerization apparatus to the reader and at the same time to serve as a polymerization procedure instruction. The apparatus was designed to be as flexible as possible - in other words, to support the homo-, co-, and terpolymerization of ethylene, propylene, 1-butene, and higher alpha olefins in bulk, slurry, or in gas phase with the facility to control the molecular weights. The polymerization temperature, like pressure and flow rates of different monomers, is controlled automatically and covers the range from -50 to 80 C. Author

N92-22044* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TOUGH, HIGH PERFORMANCE, ADDITION-TYPE THERMOPLASTIC POLYMERS Patent
Ruth H. Pater, inventor (to NASA) 14 Jan. 1992 22 p Filed 13 Nov. 1989 Continuation-in-part of abandoned US-Patent-Appl-SN-250480, filed 28 Sep. 1988
(NASA-Case-LAR-14346-1; US-Patent-5,081,198;
US-Patent-Appl-SN-434195; US-Patent-Appl-SN-250480;
US-Patent-Class-526-262; US-Patent-Class-526-248;
US-Patent-Class-526-249; US-Patent-Class-525-275;
US-Patent-Class-525-421; US-Patent-Class-525-422) Avail: US Patent and Trademark Office CSCL 11C

A tough, high performance polyimide is provided by reacting a triple bond conjugated with an aromatic ring in a bisethynyl compound with the active double bond in a compound containing a double bond activated toward the formation of a Diels-Adler type adduct, especially a bismaleimide, a biscitraconimide, or a benzoquinone, or mixtures thereof. Addition curing of this product produces a high linear polymeric structure and heat treating the highly linear polymeric structure produces a thermally stable aromatic addition-type thermoplastic polyimide, which finds utility in the preparation of molding compounds, adhesive compositions, and polymer matrix composites.
Official Gazette of the U.S. Patent and Trademark Office

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N92-21072# Lawrence Livermore National Lab., CA.
SENSITIVITY STUDY OF THE CJ POINT OF LX-14 TO NEW EOS PARAMETERS OF DETONATION PRODUCTS
M. vanThiel and F. H. Ree Nov. 1991 8 p Presented at the 8th Biennial Nuclear Explosives Design Conference, Los Alamos, NM, 18-22 Nov. 1991
(Contract W-7405-eng-48)
(DE92-006893; UCRL-JC-109025; CONF-9111181-1) Avail: NTIS HC/MF A02

The statistical mechanical chemical equilibrium code, CHEQ, has been successfully used to predict the EOS of complex post-detonation mixtures produced from explosives. An accurate three-phase EOS of carbon, improvements in the CHEQ code and more detailed experimental data for other molecules are now available. These have been used to test the currently available EOS-set employed in mixture calculations. The study of these data not only allow us to improve the EOS of the pure components, but indicates that chemically active radicals and the higher order corrections to the potentials of unlike species in the mixture, are also important. We shall briefly discuss the improvements in the EOS made so far. Finally, the sensitivity of the predicted detonation velocity of LX-14 to the EOS changes is discussed. DOE

N92-21133# Department of Energy, Washington, DC. Office of Energy Management.
HYDROGEN ENERGY COORDINATING COMMITTEE: SUMMARY OF DOE HYDROGEN PROGRAMS Annual Report, FY 1991
Jul. 1991 51 p
(DE92-006785; DOE/CE-0341) Avail: NTIS HC/MF A04

The HECC was established over 13 years ago to ensure that the many varied aspects of hydrogen technology within the Department are coordinated. Each year the committee brings together technical representative within the Department to coordinate activities, share research results and discuss future priorities and directions. This FY 1990 summary is the thirteenth consecutive yearly report. It provides an overview of the hydrogen related programs of the DOE offices represented in the HECC for the fiscal year. For the purposes of this report, the research projects within each division have been organized into two categories: Fuels related Research and Non-fuels-related Research. An historical summary of the hydrogen budgets of the several divisions is given. Total DOE funding in FY 1990 was $6.8 million for fuels related research and $32.9 million for nonfuels related research. The individual program elements are described in the body of this report, and more specific program information can be found in the Technology Summary Forms in Appendix A. DOE

N92-21228# Hamburg Univ. (Germany, F.R.).
MEASUREMENTS OF PROPELLANT QUANTITIES FOR SPACE VEHICLES UNDER WEIGHTLESSNESS Ph.D. Thesis [MESSUNGEN VON TREIBSTOFFMENGEN FUER RAUMFAHRZEUGE UNTER SCHWERELOSIGKEIT]
Thorsten Behring 1991 135 p In GERMAN
(ETN-92-91001) Avail: NTIS HC/MF A07

A propellant measurement process is developed and tested. Two variables, which determine the amount of gas flowing in the tank, are examined. The propellant tank internal pressure is such that the fluids can be injected into the propulsion chambers. The derived thermodynamical process utilizes the propellant tank pressure phenomenon. The gas volume in the tank is calculated from pressure and temperature measurements during the operation. The dependency on pressure and temperature is shown in a parameter study. Measurements were carried out during short periods of simulated weightlessness. ESA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology.*

N92-21385*# Virginia Univ., Charlottesville. Dept. of Chemical Engineering.
MICROGRAVITY NUCLEATION AND PARTICLE COAGULATION EXPERIMENTS SUPPORT Status Report No. 7, 1 Jan. - 31 Dec. 1991
L. U. Lilleleht, F. T. Ferguson, and J. R. Stephens (Matrix Corp., Santa Fe, NM.) Mar. 1992 16 p
(Grant NAG5-865)
(NASA-CR-190159; NAS 1.26:190159; UVA/528260/CHE92/107)
Avail: NTIS HC/MF A03 CSCL 22A

Modifications to the nucleation apparatus suggested by our first microgravity flight campaign are complete. These included a complete 'repackaging' of the equipment into three racks along with an improved vapor spout shutter mechanism and additional thermocouples for gas temperature measurements. The 'repackaged' apparatus was used in two KC-135 campaigns: one during the week of June 3, 1991 consisting of two flights with Mg and two with Zn, and another series consisting of three flights with Zn during the week of September 23, 1991. Our effort then was focused on the analysis of these data, including further development of the mathematical models to generate the values of temperature and supersaturation at the observed points of nucleation. The efforts to apply Hale's Scaled Nucleation Theory to our experimental data have met with only limited success, most likely due to still inadequate temperature field determination. Work on the development of a preliminary particle collector system designed to capture particles from the region of nucleation and condensation, as well as from other parts of the chamber, are discussed. Author

N92-21433*# Virginia Univ., Charlottesville. Dept. of Chemical Engineering.
MICROGRAVITY NUCLEATION AND PARTICLE COAGULATION EXPERIMENTS SUPPORT Status Report No. 6, 1 Mar. - 31 Dec. 1990
L. U. Lilleleht, F. T. Ferguson, and J. R. Stephens Jan. 1992 25 p Prepared in cooperation with Matrix Corp., Santa Fe, NM
(Grant NAG5-865)
(NASA-CR-189899; NAS 1.26:189899; UVA/528260/CHE92/106)
Avail: NTIS HC/MF A03 CSCL 22A

This project is a part of a program at GSFC to study to formation and growth of cosmic dust grain analogs under terrestrial as well as microgravity conditions. Its primary scientific objective is to study the homogeneous nucleation of refractory metal vapors and a variety of their oxides among others, while the engineering, and perhaps a more immediate objective is to develop a system capable of producing mono-dispersed, homogeneous suspensions of well-characterized refractory particles for various particle interaction experiments aboard the Space Shuttle and Space Station Freedom. Both of these objectives are to be met by a judicious combination of laboratory experiments on the ground and aboard NASA's KC-135 experimental research aircraft. Major effort during the current reporting period was devoted to the evaluation of our very successful first series of microgravity test runs in Feb. 1990. Although the apparatus performed well, it was decided to 'repackage' the equipment for easier installation on the KC-135 and access to various components. It will now consist of three separate racks: one each for the nucleation chamber, the power subsystem, and the electronic packages. The racks were fabricated at the University of Virginia and the assembly of the repackaged units is proceeding well. Preliminary analysis of the video data from the first microgravity flight series was performed and the results appear to display some trends expected from Hale's Scaled Nucleation Theory of 1986. The data acquisition system is currently being refined. Author

N92-22091# National Space Development Agency, Tokyo (Japan). Space Experiment Group.
DEVELOPMENT OF FMPT (FUWATTO 1991)
Norio Soichi *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 31-63 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N92-21086# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
STUDY, MANUFACTURE, AND CONTROL OF A POWER SYSTEM ELECTROHYDRAULIC ACTUATOR Ph.D. Thesis - Toulouse Univ. [ETUDE, REALISATION ET COMMANDE D'UN ACTIONNEUR ELECTROHYDRAULIQUE DE PUISSANCE]
Boumediene Bouanane 1991 149 p In FRENCH; ENGLISH summary
(LAAS-91283; ETN-92-90854) Avail: NTIS HC/MF A07

An innovative solution to the problem posed by high power actuators is proposed. A hydrostatic system concept highlighting the possibility of using mechanical bellows as a specific actuator is validated by means of a feasibility study. Based on this concept, a mechanical structure is defined in the form of a two degree of freedom platform involving eight bellows. An electric environment allowing the platform to be controlled by servomotors is described. A data processing environment enabling a command architecture to be implemented for position control is described. Use of the electrohydraulic actuator proposed is predicted to result in a greatly enhanced power to weight ratio of the power structures. ESA

N92-21184*# National Aeronautics and Space Administration, Washington, DC.
NASA SAFETY STANDARD FOR LIFTING DEVICES AND EQUIPMENT
Sep. 1990 99 p
(NASA-TM-107786; NSS/GO-1740.9B; NAS 1.15:107786) Avail: NTIS HC/MF A05 CSCL 13B

NASA's minimum safety requirements are established for the design, testing, inspection, maintenance, certification, and use of overhead and gantry cranes (including top running monorail, underhung, and jib cranes), mobile cranes, derrick hoists, and special hoist supported personnel lifting devices (these do not include elevators, ground supported personnel lifts, or powered platforms). Minimum requirements are also addressed for the testing, inspection, and use of Hydra-sets, hooks, and slings. Safety standards are thoroughly detailed. Author

N92-21255# Oxford Univ. (England). Dept. of Engineering Science.
A GENERAL ZONE MODEL FOR HVACSIM(+) USER'S MANUAL
Edward F. Sowell (California State Coll., Fullerton.) 1991 65 p
(OUEL-1889/91; ETN-92-91085) Avail: NTIS HC/MF A04

A general thermal model of a building zone or room implemented as a module for the HVACSIM+ simulation program is described. This model differs from other zone models for modular simulators in the level of detail with which thermal processes can be represented. For example, the zone can be represented by an arbitrary number of nodes, among which there can be heat transfer by conduction, convection, and radiation. In particular, the lighting system can be modeled in detail, including the nonlinear power and light output of fluorescent lamps versus lamp wall temperature. Both short and long wavelength diffuse radiation is modeled. If desired, a plenum formed by a suspended ceiling can be included, and air flow can be routed through the zone and plenum in a manner specified by the user. If the need is for a simple zone model, most of the details can be omitted. From the perspective of the HVACSIM+ user, the model is like other TYPE subroutines, with inputs and outputs that allow it to be connected with other modules, and parameters that allow it to be specialized to particular zone characteristics. These HVACSIM+ interface sets are of reasonable size due to placing the details of the zone definition in a separate file. ESA

N92-21283# Superconducting Super Collider Lab., Dallas, TX.
SUPERCONDUCTING SUPER COLLIDER: A STEP IN THE 21ST CENTURY
M. McAshan Aug. 1991 23 p Presented at the International Congress on Refrigeration: New Challenges in Refrigeration, Montreal (Canada), 10-17 Aug. 1991 Submitted for publication
(Contract DE-AC35-89ER-40486)
(DE92-006984; SSCL-Preprint-20; CONF-910803-7) Avail: NTIS HC/MF A03

The development of superconducting materials and the development of helium temperature refrigeration technology have both been propelled by their wide application in large-scale scientific research. The development of materials and technology for the Tevatron proton storage ring at Fermi National Accelerator Laboratory, Batavia, IL USA, in the decade of the seventies provided the basis in the decade of the eighties, for example, for the use of superconducting helium-cooled whole-body magnets for magnetic resonance imaging in medical diagnosis. In the decade of the nineties a number of particle accelerators for high energy physics will be constructed in national and international laboratories around the world. These devices will employ superconductivity on an ambitious scale, and their operation will require more than double the amount of helium refrigeration capacity now installed worldwide. This large increase in the use of helium refrigeration will have a significant effect on the technology and on the industry that produces it. The largest of these accelerator projects is the Superconducting Super Collider (SSC) now under construction at a new laboratory near Dallas, TX USA. This report discusses the development of this cryogenic system for the SSC magnets. DOE

N92-21735# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A PRODUCTION SYSTEMS DESIGN AID BASED ON DATA SIMULATION AND ANALYSIS, VOLUME 2 Ph.D. Thesis [UNE AIDE A LA CONCEPTION DE SYSTEMES DE PRODUCTION BASEE SUR LA SIMULATION ET L'ANALYSE DE DONNEES (VOLUME 2)]
Christine Heritier-Pingeon 1991 95 p In FRENCH
(ISAL-91-0020-Vol-2; ETN-92-90856) Avail: NTIS HC/MF A05

The need for production systems to be increasingly flexible is stressed. In the case of automated systems, decisions made early on in the conception phase will greatly effect the future possibilities of the system as well as its ability to adapt to changes. Decision making tools and methods are studied. The workshop model used as the basis for the study is presented. Knowledge acquisition methods and their effect on the behavior and performance of production systems is studied. An analytic method is proposed and used experimentally. The results of the experimental application are presented. ESA

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N92-21095# Beleidscommissie Remote Sensing, Delft (Netherlands).
FEMIS: A FLEXIBLE MICROWAVE IMAGE SIMULATOR
J. C. M. Kleijweg (Physics and Electronics Lab. TNO, The Hague, Netherlands) Jul. 1991 28 p In DUTCH; ENGLISH summary

(BCRS Proj. AO-2.23)
(BCRS-91-18; FEL-1991; ETN-92-90986) Avail: NTIS HC/MF A03

An image simulation software package (FEMIS) was developed, starting from existing physical models, data inventories and data from scatterometer campaigns, especially from agricultural applications. FEMIS can simulate radar images in a conditional way, using the knowledge of physical imaging. The simulation of images consists of a so called generation phase and a simulation phase. Using a topographic map a number of global parameters can be indicated in the generation phase for a given object or segment. The global parameter generation is a fast and efficient procedure. Using these global parameters the image is simulated on the simulation phase. In both phases the parameters can be modified interactively and the results can be directly monitored. The package is modular, easy to extend, and flexible in use.
ESA

N92-21172# Communications Research Centre, Ottawa (Ontario).
CODE-SHIFT KEYING FOR FREQUENCY-HOPPING HF SYSTEMS WITH MULTIPATH PROPAGATION
G. O. Venier Jun. 1991 37 p
(AD-A245223; CRC-1437) Avail: NTIS HC/MF A03 CSCL 12/9

'Code shift keying' systems transmitting M-ary nonorthogonal codes, and using multiple-delay correlators for demodulation, offer significant advantages over more conventional methods in HF frequency hopping systems operating in fading multipath conditions. They can give good 'bit error rate' performance with high hop rates and moderate data throughput rates, while avoiding intersymbol interference and providing diversity gain against fading when multiple paths exist. This report describes the proposed CSK technique and presents design information. A particular design is chosen for demonstration, and simulation tests of that design are described. These demonstrate the performance improvement of the system, in comparison with 'frequency shift keying' and 'differential phase shift keying' systems, in a two-path medium in which each path has Rayleigh fading. conditions; the extension to multi-phase codes; and the application of trellis coding to the CSK symbols. GRA

N92-21230# Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftlichen Fachbereich.
EXAMINATIONS OF TRAVELING IONOSPHERIC DISTURBANCES (TIDs) IN THE F-LAYER OF THE POLAR LIGHT ZONE, USING EISCAT DATA Ph.D. Thesis [UNTERSUCHUNGEN AN 'TRAVELLING IONOSPHERIC DISTURBANCES' IN DER F-SCHICHT DER POLARLICHTZONE MIT HILFE VON EISCAT-DATEN]
Heinz-Peter Mauelshagen 1990 121 p In GERMAN
(ETN-92-91003) Avail: NTIS HC/MF A06

Indications of the fullness of the various types of Traveling Ionospheric Disturbances (TID) in the F layer of the polar light zone are given. The European Incoherent Scatter (EISCAT) Common Program 2 data allow detailed examinations of each distinct type of TID. The different behaviors in the various ionospheric parameters can be accurately examined for each type of TID. The transition between wave motion in a drifting medium to wave refraction, up to wave formation and the clean matter transportation, can be extensively considered, because the observation points are thicker than the structure diameter. ESA

N92-21238# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Abt. HF-Physik.
PHASED ARRAY FOR MOBILE SATELLITE COMMUNICATIONS
Volker Ziegler Nov. 1990 79 p In GERMAN, ENGLISH summary
(DLR-FB-91-21; ISSN-0939-2963; ETN-92-91064) Avail: NTIS HC/MF A05; DLR, Wissenschftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 39.50 DM

An L-band phased array antenna concept for mobile satellite communications is presented. The array is a multilayer structure with integrated 4-bit switched stub phase shifters and aperture coupled right hand circularly polarized antenna elements. The integrated phased array has an interface for direct computer control. Diagrams describing the operation and structure of the antenna are shown. ESA

N92-21280# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
REFLECTION AND TRANSMISSION OF PLANE WAVES AT A PLANAR INTERFACE BETWEEN ISOTROPIC AND BI-ISOTROPIC MEDIA
I. V. Lindell, A. H. Sihvola, and A. J. Viitanen Aug. 1991 28 p
(PB92-128461; ISBN-951-22-0771-0; Rept-100) Avail: NTIS HC/MF A03 CSCL 20N

Reflection and transmission of a plane wave at the planar interface of isotropic and bi-isotropic (BI) media are analyzed. The analysis applies vector transmission line theory, which for the general case is seen to involve both dyadic impedance and dyadic propagation factor quantities. Explicit expressions for the reflection and transmission dyadics are given and their special cases for the Tellegen, nonreciprocal nonchiral, media are obtained and confirmed by previous results. Eigen polarizations for the reflection dyadic are found and conditions for zeros of eigen reflections are worked out to give explicit expressions for Brewster angles corresponding to the BI interface. A new phenomenon is the appearance of two Brewster angles for certain material parameter values of bi-isotropic half space. Also, conditions for zeros of cross-polarized reflections are found for the general case. These nonreciprocal cross Brewster angles for which, a horizontally polarized wave gives no vertically polarized reflection whereas a vertically polarized wave gives nonzero horizontally polarized reflection, may find practical applications because this effect does not appear for special cases of Tellegen and Pasteur media.
Author

N92-21281# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
BIISOTROPIC LAYER AS A POLARIZATION TRANSFORMER
S. A. Tretyakov and M. I. Oksanen Aug. 1991 16 p Sponsored in part by Suomen Akatemja, Helsinki, Finland
(PB92-128479; ISBN-951-22-0770-2; Rept-101) Avail: NTIS HC/MF A03 CSCL 20N

Possible applications of biisotropic, nonreciprocal chiral, materials in radar and antenna technology are proposed. Electromagnetic properties of these materials are governed by four parameters, and with specific material parameter values, a thin biisotropic layer can serve as a nearly ideal polarization transformer in extremely wide frequency ranges. Also, there are more tools in achieving other desirable effects like small reflection etc., which makes the material perspective in radar cross-section management technology. Author

N92-21292# McMaster Univ., Hamilton (Ontario). Faculty of Engineering.
A STUDY OF SUPERRESOLUTION DIRECTION FINDING USING PRACTICAL VHF CIRCULAR ARRAY ANTENNAS, PART 1 Final Report
John Litva and Jason Qian Aug. 1990 87 p Sponsored by Defence Research Establishment
(CTN-92-60425) Avail: NTIS HC/MF A05

A circular array antenna is attractive for direction finding (DF) because of its geometrically circular symmetry and the periodicity of its electromagnetic features, such as mutual coupling between elements of the array when its beam is scanned electronically through 360 deg in azimuth. The element voltage response to an incident plane wave of a circular array are generally used as input for the DF signal processing. In this report, the effects of the element response to the mutual coupling in the circular array, lossy ground, and the polarization and elevation angle of the incident wave are studied. Software for the efficient analysis of the element response of a circular array of dipoles was developed.

The DF algorithms based on the MUSIC and the maximum likelihood methods were evaluated. It was shown that, for circular array direction finding, algorithms based on ideal response models exhibit significantly degraded performance and highly biased direction of arrival estimates. The DF algorithms were then modified to compensate for mutual coupling effects and the performance of the modified algorithms under typical operating conditions was simulated. Author (CISTI)

N92-21316# McMaster Univ., Hamilton (Ontario). Faculty of Engineering.

APPLICATION OF HIGH-RESOLUTION DIRECTION-FINDING ALGORITHMS TO CIRCULAR ARRAYS WITH MUTUAL COUPLING PRESENT, PART 2 Final Report

John Litva and Mehmet Zeytinoglu Jul. 1990 38 p Sponsored by Defence Research Establishment

(CTN-92-60426) Avail: NTIS HC/MF A03

A study of the effects of mutual coupling on the performance on direction finding algorithms is presented. The MUltiple SIgnal Classification (MUSIC) and maximum likelihood (ML) algorithms resolved non-coherent and coherent incident wave fields with relative ease when ideal array response models were used. When array output vectors were simulated using free space and lossy ground models which include mutual coupling effects, the performance of the unmodified direction finding algorithms declined sharply. In particular, estimates from unmodified algorithms exhibited a constant, deterministic bias term. Algorithms modified for this bias term displayed a significant residual bias in attempts to resolve incident wave field with closely spaced source signals. Array steering vectors are the main components through which the array models are coupled. Free space and lossy ground response modes that take mutual coupling effects into consideration were modified by assembling array steering vectors directly from simulated raw data. These modified algorithms exhibited exemplary performance in resolving fields from closely spaced source signals when the array output vectors were derived from the same free space or lossy ground models. The MUSIC algorithm permitted array steering vectors modified with free space response data to be used with the array output derived for the lossy ground response mode. However, it was applicable only to non-coherent source signals. The ML algorithm performed equally well with non-correlated and coherent source signals but it had to be perfectly matched with the actual array response. Computation requirements were very demanding for the ML algorithm. CISTI

N92-21326# Georgia Inst. of Tech., Atlanta. Bioengineering Center.

MILLIMETER-WAVE EXPOSURE SYSTEM AUGMENTATION Final Report, Jun. 1989 - Jun. 1990

Wesley W. Shelton Nov. 1991 55 p

(Contract F33615-87-D-0626)

(AD-A244473; AL-TR-1991-0056) Avail: NTIS HC/MF A04 CSCL 20/14

Dielectric lenses, a pedestal, and a remote-controlled positioner were designed, constructed, delivered, and installed for the Armstrong Laboratory/OEDR millimeter-wave facility which consists of a 75-W 35-GHz transmitter, a 50-W 94.5-GHz transmitter, and a millimeter-wave anechoic chamber. Gaussian optics was used in the lens design and concentric sets of grooves were used to optimize the transmission characteristic of the lenses by impedance matching. With the lenses, power densities on the order of 1 W/sq. cm. can be produced for a spot with a 3-cm (1.18 in.) diameter. A pedestal system was designed and constructed which could support specimens and be millimeter-wave transparent. The remote-controlled positioner is capable of positioning a millimeter-wave field probe within a 1 m X 0.5 m X 0.5 m (3.28 ft X 1.69 ft X 1.69 ft) volume. The system is also capable of feeding back to a remote computer the position of the probe. Author (GRA)

N92-21327# Vista Research Corp., Mountain View, CA.

IMPROVED PROPAGATION MODELS IRREGULAR MEDIA Final Report, 7 Jan. 1989 - 6 Jul. 1991

Charles L. Rino 30 Jun. 1991 15 p

(Contract DAAL03-89-C-0011)

(AD-A244474; ARO-26480.4-GS-S) Avail: NTIS HC/MF A03 CSCL 20/1

In continuous random media, one invariably uses the parabolic approximation to the wave equation. Thus, the development of moment equations that characterize the random field proceeds from a model that excludes a priori wide-angle scattering and backscatter. While attempts have been made to rectify both limitations, the formulations used are intractable or inconsistent. It is desirable to use a formulation that accommodates backscatter and wideangle scatter at the outset. In discrete random media, the formalism developed by Flody, Lax, and Twersky is more often used. The problem development is setup so that a self-consistent computation of the complete multiple scattering interactions among all the scatters is accommodated. It is known that self-consistent interaction computations can be set up as solutions to differential equations as well as implicit summations of all interactions (diagram methods). Whereas the continuous media problem generally proceed from a system of restricted differential equations, the discrete problem more often proceeds an exact diagram system. It is desirable to use a common formulation that preserves the self-consistent interaction fields but can be transformed to diagram form. GRA

N92-21330# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.

AN EXPERIMENTAL SPATIAL ACQUISITION AND TRACKING SYSTEM FOR OPTICAL INTERSATELLITE CROSSLINKS

D. J. Bernays and E. P. Colagiuri-Cafarelli 3 Dec. 1991 135 p

(Contract F19628-90-C-0002)

(AD-A244636; TR-923; ESD-TR-91-090) Avail: NTIS HC/MF A07 CSCL 25/5

Optical intersatellite communications crosslinks will operate with much higher antenna gains and hence more stringent pointing and tracking requirements than do present RF and microwave-based systems. The design and experimental demonstration of an optical heterodyne communications receiver that includes an integrated 2-axis spatial acquisition subsystem and heterodyne tracker are presented. Requirements for the acquisition and tracking system are derived from the Laser Intersatellite Transmission Experiment (LITE). The acquisition subsystem employs a parallel search algorithm using a direct detection, charge-coupled device (CCD) array. The heterodyne spatial tracker is based upon angle detection in the pupil plane. It uses a commutating, correlation demodulation scheme to reduce front-end-noise-induced biases relative to those from square law detection in the track channel alone. A robust handoff algorithm is presented for the transition between CCD-based acquisition and heterodyne spatial tracking. Results from a laboratory demonstration system are presented. GRA

N92-21409 British Broadcasting Corp., Kingswood (England). Engineering Div.

HDTV SOUND: PROGRAMME PRODUCTION DEVELOPMENTS

D. J. Meares 1991 23 p

(BBC-RD-1991/14) Copyright Avail: Issuing Activity

The British Broadcasting Corporation's (BBC) program experiments, between 1989 and 1990, with multichannel sound for High Definition Television (HDTV) are presented. Among the issues examined are: on-site recording, post-production activities, exploitation of multichannel sound, and compatibility. Existing facilities are shown to be adaptable to multichannel sound production, although purpose-designed facilities would be better. Other aspects of system design, particularly the transmission constraints, will further influence the development of a compatible multichannel sound system for HDTV. H.A.

N92-21709*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.

CONICAL CUT RADAR CROSS SECTION CALCULATIONS FOR A THIN, PERFECTLY CONDUCTING PLATE

Raymond J. Luebbers and John H. Beggs Mar. 1991 13 p

(Grant NAG2-648)
(NASA-CR-190107; NAS 1.26:190107) Avail: NTIS HC/MF A03 CSCL 20N

Radar cross section (RCS) calculations for flat, perfectly conducting plates are readily available through the use of conventional frequency domain techniques such as the method of moments. However, if time domain scattering or wideband frequency domain results are desired, then the finite difference time domain (FDTD) technique is a suitable choice. We present the application of the FDTD technique to the problem of electromagnetic scattering and RCS calculations from a thin, perfectly conducting plate for a conical cut in the scattering angle phi. RCS calculations versus angle phi are presented and discussed. Author

N92-21712* National Aeronautics and Space Administration. Pasadena Office, CA.
DIGITAL CARRIER DEMODULATOR EMPLOYING COMPONENTS WORKING BEYOND NORMAL LIMITS Patent
William J. Hurd, inventor (to NASA) and Ramin Sadr, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 7 Aug. 1990 6 p Filed 12 May 1989 Supersedes N89-28684 (27 - 23, p 3276)
(NASA-Case-NPO-17628-1-CU; US-Patent-4,947,408; US-Patent-Appl-SN-350813; US-Patent-Class-375-94; US-Patent-Class-375-80; US-Patent-Class-329-310; Int-Patent-Class-H03D-1/06) Avail: US Patent and Trademark Office CSCL 20N

In a digital device, having an input comprised of a digital sample stream at a frequency F, a method is disclosed for employing a component designed to work at a frequency less than F. The method, in general, is comprised of the following steps: dividing the digital sample stream into odd and even digital samples streams each at a frequency of F/2; passing one of the digital sample streams through the component designed to work at a frequency less than F where the component responds only to the odd or even digital samples in one of the digital sample streams; delaying the other digital sample streams for the time it takes the digital sample stream to pass through the component; and adding the one digital sample stream after passing through the component with the other delayed digital sample streams. In the specific example, the component is a finite impulse response filter of the order ((N + 1)/2) and the delaying step comprised passing the other digital sample streams through a shift register for a time (in sampling periods) of ((N + 1)/2) + r, where r is a pipline delay through the finite impulse response filter.
Official Gazette of the U.S. Patent and Trademark Office

N92-21713# Helsinki Univ. of Technology, Espoo (Finland). Communications Lab.
MICROWAVE LINE-OF-SIGHT CHANNEL MEASUREMENTS, CHANNEL MODELLING, AND APPLICATION OF CHANNEL MODELS TO DIGITAL RADIO PERFORMANCE PREDICTION, PUBLICATIONS
S. G. Haeggman 10 Jun. 1991 97 p
(PB92-133537; ISBN-951-22-0689-7; T-29) Avail: NTIS HC/MF A05 CSCL 20N

Seven scientific papers published during 1978 to 1990 are reviewed. The papers constitute the basis for a PhD. The titles of the 7 papers are as follows: Time domain observation of microwave multipath propagation and estimation of channel model parameters; Microwave channel model parameters from pulse propagation measurements; The use of simple channel models in the analysis of 16 QAM radio links; Multipath outage probability for QAM systems with interference; Planning of propagation measurements for characterization of digital radio link channels; Measurement and statistical characterization of two 40 MHz line of sight radio channels at 6.2 GHz; and Effects on bandwidth on microwave line of sight channel modeling and digital radio performance prediction. Author

N92-21747# Beleidscommissie Remote Sensing, Delft (Netherlands).
TESTING OF THE USEFULNESS OF THE HIGH FREQUENCY RADAR SYSTEM FOR THE MEASUREMENT OF SURFACE FLOWS USING MEASUREMENTS IN ZEELAND (NETHERLANDS) AND NORTH HOLLAND (NETHERLANDS) IN NOVEMBER 1988 [TOESTING VAN DE BRUIKSBAARHEID VAN HET HF-RADAR SYSTEEM VOOR HET METEN VAN OPPERVLAKTESTROMINGEN DOOR MIDDEL VAN METINGEN IN ZEELAND EN NOORD-HOLLAND IN NOVEMBER 1988]
Aug. 1991 74 p In DUTCH Prepared in cooperation with Rijkswaterstaat Dienst Getijdewateren, The Hague, Netherlands
(BCRS-91-13; AVN-91-04; ETN-92-90987) Avail: NTIS HC/MF A04

The MAREX HF radar remote sensing system was tested for its usefulness in measuring surface flow in the North Sea. The high correlation coefficients between HF and conventional measurements show the reliability of HF radar measurements, the results of which are much faster available than with the other techniques. It has to be further investigated if HF measurements are useful for the determination of depth averaged velocities. It can be concluded that the HF radar system proved to be useful, and that the fall out of data is very low. ESA

N92-21760# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
ELECTROMAGNETIC WAVES IN LAYERED GENERAL BI-ISOTROPIC STRUCTURES
S. Tretyakov and M. Oksanen Jun. 1991 23 p Sponsored by Suomen Akatemja, Helsinki
(PB92-134048; ISBN-951-22-0714-1; Rept-96) Avail: NTIS HC/MF A03 CSCL 20N

The vector circuit theory developed for isotropic and chiral slabs and multilayered structures is generalized for bi-isotropic (nonreciprocal chiral) media slabs and multilayered structures. The theory appears to be similar to that used for reciprocal structures and enables one to study plane wave reflection and transmission for arbitrary polarized waves coming at oblique angles of incidence. The numerical examples clarify the combined effect of chirality and nonreciprocity of the media on reflection and transmission characteristics of bi-isotropic layers. GRA

N92-21761# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
ELECTROMAGNETIC WAVES IN BI-ISOTROPIC WAVEGUIDES
S. Tretyakov, M. Oksanen, and P. Koivisto Jun. 1991 21 p Sponsored by Suomen Akatemja, Helsinki
(PB92-134055; ISBN-951-22-0715-X; Rept-97) Avail: NTIS HC/MF A03 CSCL 20N

Eigenvalue equations for guided modes in a general class of bi-isotropic waveguides were derived. The analysis uses field decomposition techniques in order to simplify wave equations in bi-isotropic medium. Using characteristic electric and magnetic field ratios subject to particular waveguide surface impedances, corresponding eigenvalue are derived first for arbitrary waveguide cross sections and then applied to a special circular cross section. The following special boundary impedance conditions were covered: ideally conducting surface, impedance surface, anisotropic surface, and open surface. In all cases, the waveguide filling can be either bi-isotropic or chiral. The eigenvalue equations will be compared with other existing results from the literature. GRA

N92-21762# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
PLANE-WAVE REFLECTION FROM A BI-ISOTROPIC (NONRECIPROCAL CHIRAL) INTERFACE
I. V. Lindell, A. H. Sihvola, and A. J. Viitanen Aug. 1991 12 p
(PB92-134063; ISBN-951-22-0746-X; Rept-98) Avail: NTIS HC/MF A03 CSCL 20N

The reflection dyadic for an incident plane wave reflecting at a planar interface between isotropic and bi-isotropic (nonreciprocal chiral) half spaces is presented. The result generalizes earlier

expressions for Fresnel's formulas for different isotropic and chiral half spaces. GRA

N92-21770# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

MAGNETOSTATIC IMAGE THEORY FOR THE PERMEABLE SPHERE

I. V. Lindell and E. A. Lehtola Jan. 1991 19 p Sponsored by Suomen Akatemja, Helsinki

(PB92-134006; ISBN-951-22-0493-2; Rept-82) Avail: NTIS HC/MF A03 CSCL 20N

The image of an electrostatic point charge in a conducting sphere, produced by Kelvin's inversion theory, has become well known since its formulation in 1848. The corresponding image theory in terms of a point charge plus a line charge was recently developed for the dielectric sphere. The theory is adapted to the magnetically polarizable sphere with magnetic charges, dipoles, or current loops as sources. For the current loop, the image is seen to consist of a conical surface current plus an edge line current with expressions simple enough to allow numerical computations with a pocket calculator. A recently published result for the superconducting sphere is seen to be a special case of the present theory for mu = 0. GRA

N92-21771# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

PERCOLATION THRESHOLD AND DIELECTRIC MIXING RULES

A. H. Sihvola May 1991 11 p

(PB92-134030; ISBN-951-22-0668-4; Rept-95) Avail: NTIS HC/MF A03 CSCL 20N

The percolation threshold is studied from the point of view of dielectric mixtures. In quasi-static mixing rules applied in predicting macroscopic permittivities of dielectrically heterogeneous media, the percolation behavior can be found for high dielectric contrasts between the phases. A family of mixing rules is studied that is generated by varying a certain parameter, nu, in the mixing formula, and the percolation threshold as a function of nu is derived. The threshold is shown to be the same if conductivity is considered. Also, the spatial dimension is varied. The results show that the Maxwell-Garnett mixing rule predicts threshold p(c) = 1, a higher value than the other rules, and also higher than normally encountered in disordered media. GRA

N92-21787# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

ANALYTICAL SOLUTIONS OF SOME ELECTROMAGNETIC PROBLEMS INVOLVING CHIRAL, BI-ISOTROPIC, AND UNIAXIAL MEDIA Ph.D. Thesis

A. J. Viitanen May 1991 21 p

(PB92-134022; ISBN-951-22-0653-6; Rept-92) Avail: NTIS HC/MF A03 CSCL 20N

A survey was performed and a summary was made of the following publications: Geometrical optics in inhomogeneous chiral media with application to polarization correction of inhomogeneous microwave lens antennas; Polarization correction of Luneburg lens with chiral medium; Polarization correction of Gutman lens with chiral medium; Eigensolutions for the reflection problem of the interface of two chiral half-spaces; Generalized WKB approximation for stratified isotropic chiral media with obliquely incident plane wave; Duality transformations for general bi-isotropic (nonreciprocal chiral) media; WKB approximation for stratified bi-isotropic media; and Exact image theory for uniaxially anisotropic dielectric half-space. Author

N92-21802# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

VECTOR CIRCUIT METHOD FOR CALCULATING REFLECTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES IN MULTILAYER CHIRAL STRUCTURES

M. I. Oksanen, J. Haenninen, and S. A. Tretyakov Nov. 1990 30 p Sponsored by Suomen Akatemja, Helsinki

(PB92-133990; ISBN-951-22-0431-2; Rept-74) Avail: NTIS HC/MF A03 CSCL 20N

Reflection and transmission characteristics are explored of single and multilayer chiral slabs. The analysis is based on vector circuit modeling of chiral slabs in terms of transverse fields, dyadic impedance, admittance or transmission matrix components. Reflection and transmission coefficients for arbitrary angles of incidence and arbitrary polarization states of the fields are derived. Using these and to exemplify the method, reflected and transmitted fields of the copolarized and cross polarized waves are calculated in single and multilayer chiral slabs for various electromagnetic and geometrical parameter values. Author

N92-21803# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

BI-ISOTROPIC MIXTURES

A. H. Sihvola Mar. 1991 28 p Sponsored by Suomen Akatemja, Helsinki

(PB92-134014; ISBN-951-22-0574-2; Rept-89) Avail: NTIS HC/MF A03 CSCL 20N

Bi-isotropic heterogeneous media are analyzed. Bi-isotropic materials are characterized by four scalar parameters in the constitutive relations: permittivity, permeability, chirality, and nonreciprocity. The polarizabilities of general bi-isotropic spheres and elipsoids are derived, and these results are used consequently in the analysis of bi-isotropic mixtures. The generalized Maxwell-Garnett formulae are derived for mixtures with spherical or ellipsoidal inclusions in isotropic background medium. The ellipsoids are allowed also to have any orientation distribution. Rayleigh mixing rules are also presented and they are seen to be a natural extension of the Rayleigh rule in the dielectric case. Also, the relation of the results is discussed to the systems employing other sets of constitutive relations for bi-isotropic media. Numerical illustrations are performed that show the effect of shape, amount, and nature of inclusions on the bi-isotropic mixture parameters; this is essential information in the engineering problem of tailoring bi-isotropic composite materials. Author

N92-21805# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

EFFECT OF BACKWALL REFLECTIONS IN A COMPACT ANTENNA TEST RANGE

J. Tuovinen, A. Lehto, and A. Raeisaenen Apr. 1991 16 p

(PB92-134220; ISBN-951-22-0589-0; S-191) Avail: NTIS HC/MF A03 CSCL 20N

A procedure for the calculation of the effect of backwall reflections in a compact antenna test range (CATR) is shown. In the calculation, the magnitude of the backwall reflections known from previous work and the angular spectrum of reflections measured in the work are used. The angular spectrum of the scattered reflections from the back part of an anechoic chamber was found to be very wide (greater than plus or minus 45 degrees), and the effect of backwall reflections was found to be insignificant, especially in a CATR with a long effective focal length. Author

N92-21825# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

DEVELOPMENT OF BEAM ANALYSIS AND ANTENNA MEASUREMENT TECHNIQUES AT MILLIMETER WAVES Ph.D. Thesis

J. J. A. Tuovinen 17 Jun. 1991 23 p

(PB92-134311; ISBN-951-22-0656-0; S-192) Avail: NTIS HC/MF A03 CSCL 20N

Described here is the development of beam analysis of quasi-optical components and antenna measurement techniques at millimeter wave frequencies needed with receivers mainly intended for remote sensing applications or radio astronomical studies. The work is divided into three parts: beam analysis, the development of antenna measurement techniques, and analysis of the effect of the reflections in antenna measurements. Author

N92-21828# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
PROGRESS REPORT ON ANALYSIS OF DIFFERENTIAL ATTENUATION RADAR DATA OBTAINED DURING WISP-91
B. E. Martner, R. A. Kropfli, L. E. Ash, and J. B. Snider Oct. 1991 49 p
(PB92-133800; NOAA-TM-ERL-WPL-215) Avail: NTIS HC/MF A03 CSCL 17I

Liquid water attenuates radar signals more strongly at shorter wavelengths that at longer ones. In theory, the differential attenuation at two wavelengths offers a new method for obtaining range resolved measurements of cloud liquid water content by remote sensing. A relatively inexpensive dual wavelength system was assembled from existing X band (3.2 cm) and K(a)-band (0.87 cm) radars and operated during the 1991 Winter Icing and Storms Project to experimentally test this technique. Analysis of the data is in early stages. The differential attenuation theory is described, along with experimental procedures and instrumentation, data collection, data processing, and one preliminary case study. The detailed case study of a cloud that produced very light drizzle prompted development of automated editing refinements to the original processing algorithm to remove complications from ground clutter, non-Rayleigh scattering, receiver saturation, and other factors. The overall study had potential applications to aircraft icing (safety). Author

N92-22033* National Aeronautics and Space Administration. Pasadena Office, CA.
ANALOG HARDWARE FOR DELTA-BACKPROPAGATION NEURAL NETWORKS Patent
Silvio P. Eberhardt, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 31 Mar. 1992 10 p Filed 29 Sep. 1989 Supersedes N90-16974 (28 - 9, p 1204)
(NASA-Case-NPO-17564-1-CU; US-Patent-5,101,361; US-Patent-Appl-SN-414811; US-Patent-Class-395-24; US-Patent-Class-364-807; US-Patent-Class-307-201; Int-Patent-Class-G06G-7/12) Avail: US Patent and Trademark Office CSCL 09B

This is a fully parallel analog backpropagation learning processor which comprises a plurality of programmable resistive memory elements serving as synapse connections whose values can be weighted during learning with buffer amplifiers, summing circuits, and sample-and-hold circuits arranged in a plurality of neuron layers in accordance with delta-backpropagation algorithms modified so as to control weight changes due to circuit drift.
Official Gazette of the U.S. Patent and Trademark Office

N92-22059*# Hunter Coll., New York, NY. Dept. of Physics and Astronomy.
QUADRATIC SQUEEZING: AN OVERVIEW
M. Hillery, D. Yu, and J. Bergou *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 125-135 Sponsored in part by City Univ. of NY (For primary document see N92-22045 12-74)
(Grant NSF PHY-90-00173)
Avail: NTIS HC/MF A17 CSCL 20N

N92-22066*# Academy of Sciences (USSR), Moscow. Lebedev Physics Inst.
FIELD QUANTIZATION AND SQUEEZED STATES GENERATION IN RESONATORS WITH TIME-DEPENDENT PARAMETERS
V. V. Dodonov, A. B. Klimov, and D. E. Nikonov *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 199-215 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N92-21083# Melbourne Univ., Parkville (Australia). School of Physics.
X RAY FOCUSING USING MICROCHANNEL PLATES. PART 1: THEORY
H. N. Chapman, K. A. Nugent, and S. W. Wilkins (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia) 1991 55 p
(DE92-611804; UM-P-91/30) Avail: NTIS HC/MF A04

A detailed analysis of the focusing and collimation of x-rays by microchannel plates (MCPs) is presented. The focusing effect derives from external reflection of grazing-incidence rays at the interior surfaces of the hollow channels of the MCP, and is similar to optical focusing by a thin lens. The point spread function of an MCP is given, taking into account surface roughness and misaligned channels. The calculations are based on multiply reflected rays and skew rays, and are valid for a spherically curved MCP of any thickness. The surface roughness calculation utilizes a vector perturbation theory for surface scattering, which expresses the angular distribution of scattered radiation, and consequently the point spread function, as a sum of a specularly reflected component and a diffusely reflected component. For comparison with experimental results, the effects due to a finite source and a detector aperture are also evaluated. DOE

N92-21084# Melbourne Univ., Parkville (Australia). School of Physics.
X RAY FOCUSING USING MICROCHANNEL PLATES. PART 2: EXPERIMENTS
H. N. Chapman, K. A. Nugent, A. Rode, B. Luther-Davies, and S. W. Wilkins (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia) 1991 22 p
(DE92-611805; UM-P-91/31) Avail: NTIS HC/MF A03

A microchannel plate (MCP) detector blank has been used to focus x rays of wavelength 0.154, 0.62, and 0.84 mm generated by a micro-focus x ray tube and a laser-produced plasma. The focusing effect of MCPs arises from total external reflection of x rays at the interior channel surfaces. Measurements of the intensity profiles of the images formed by the MCP have been made and compared with the predictions of a detailed model developed in a previously permitted paper. It was found that the model, which incorporates effects due to surface roughness, multiple reflections, channel misalignments, and finite source and collector sizes, gives a good description of the data. A consistent set of parameters was found from fits to the data at all three wavelengths. The channels of the MCP appear to be extremely regular, although the surfaces exhibited roughness which was estimated to have an RMS height variation of 16 (+-)1 nm and an autocorrelation length of 130 (+-)20nm. DOE

N92-21146# UGM Medical Systems, Inc., Philadelphia, PA.
THE 3D IMAGE RECONSTRUCTION FOR PET BY MULTI-SLICE REBINNING AND AXIAL FILTERING
R. M. Lewitt, G. Muehllehner, and J. S. Karp 1991 9 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991 Prepared in cooperation with Pennsylvania Univ., Philadelphia, PA
(Contract DE-FG02-88ER-60642)
(DE92-003943; CONF-911106-33) Avail: NTIS HC/MF A02

Two different approaches are used at present to reconstruct from 3D coincidence data in PET. We refer to these approaches as the single-slice rebinning approach and the fully-3D approach. The single-slice rebinning approach involves geometrical approximations, but it requires the least possible amount of computation. Fully-3D reconstruction algorithms, both iterative and

non-iterative, do not make such approximations, but require much more computation. Multi-slice rebinning with axial filtering is a new approach which attempts to achieve the geometrical accuracy of the fully-3D approach with the simplicity and modest amount of computation of the single-slice rebinning approach. The first step (multi-slice rebinning) involves rebinning of coincidence lines into a stack of 2D sinograms, where multiple sinograms are incremented for each oblique coincidence line. This operation is followed by an axial filtering operation, either before or after slice-by-slice reconstruction, to reduce the blurring in the axial direction. Tests with simulated and experimental data indicate that the new method has better geometrical accuracy than single-slice rebinning, at the cost of only a modest increase in computation. DOE

N92-21150# Argonne National Lab., IL.
STATUS OF RF SUPERCONDUCTIVITY AT ARGONNE NATIONAL LABORATORY
C. L. Bohn, J. R. Delayen, W. L. Kennedy, G. L. Nichols, C. T. Roche, L. Sagalovsky, P. M. Markovitch, K. W. Shepard, and G. P. Zinkhann 1991 4 p Presented at the 5th RF Superconductivity Workshop at DESY, Hamburg (Germany), 19-21 Aug. 1991
(Contract W-31-109-eng-38)
(DE92-006965; ANL/CP-74896; CONF-9108189-2) Avail: NTIS HC/MF A01

Argonne National Laboratory now has two groups working on the application of RF superconductivity to particle accelerators. In the Physics Division, work in RFSC began in 1971 and led to the first superconducting heavy-ion accelerator (ATLAS). Recently, work has focused on the upgrade of the facility by replacing the existing tandem injector by a new positive ion injector comprised of an electron-cyclotron-resonance source and a very low velocity superconducting linac. In the Engineering Physics Division, a new group was started in 1987 with the purpose of developing the superconducting technology for high current, high brightness linacs. Additionally, both groups collaborate in some areas of generic technology development. DOE

N92-21168# Tetra Corp., Albuquerque, NM.
DEVELOPMENT OF THE NEXT-GENERATION ELECTRIC FIELD (ELF 2) ANALYSIS CODES Technical Report, 20 Sep. 1989 - 21 Sep. 1991
Angel E. Rodriguez, Kenell J. Touryan, Patrick J. Roache, and Kambiz Salari 1 Jan. 1992 118 p
(Contract DNA001-89-C-0009)
(AD-A245203; TR-91-014; DNA-TR-91-145) Avail: NTIS HC/MF A06 CSCL 20/3

The ELF II program extended the Phase 1 codes to handle problems encountered in space pulsed power systems design, and applied the resulting next-generation ELF2 codes to numerically analyze electric stresses which could initiate potential breakdown mechanisms in critical subsystems in a specific real application of interest to SDI. The ELF codes are uniquely suited to electric field analysis in the presence of arbitrarily-shaped conductors and non-homogeneous, nonlinear and time dependent plasmas because of their unique boundary fitted grid generation approach and their efficient finite difference methods. The chosen paradigm problem was the Space Power Experiments Aboard Rockets III (SPEAR III) payload. The challenges lead to a new grid generator which conserves boundary mode stretching and a new topological flexibility based on grid cut-outs. This report describes the approaches used and new capabilities developed, including user instructions. Author (GRA)

N92-21296# California Inst. of Tech., Pasadena.
FUNDAMENTAL PROCESSES OCCURRING AT ELECTRODES Final Report, 15 Jul. 1987 - 1 Dec. 1991
Fred C. Anson 29 Aug. 1991 3 p
(Contract DAAL03-87-K-0054)
(AD-A244479; ARO-24411.9-CH) Avail: NTIS HC/MF A01 CSCL 09/1

This report summarizes the results obtained during four years (1987-1991) of research directed at the development of novel, polymeric coatings for electrode surfaces. The coating materials consisted of various polyelectrolytes based on functionalized polysiloxanes, newly synthesized block and random copolymers, and commercially available Nafion. Coatings prepared from these materials were examined experimentally to assess their abilities to retain electroactive counterions incorporated within their structures and to provide efficient ionic and electronic conduction pathways across the coatings. The permselectivities of some coatings were tested under both static (no current found) and dynamic (with current flow) conditions. A new model to account for the unusual diffusive behavior of counteractions in Nafion coatings was proposed and tested experimentally. The mobilities and counter-ion binding equilibria for a set of soluble polyelectrolytes was examined and new methods developed for evaluation of their diffusion coefficients. The coatings were tested for possible applications in electrocatalysis, electrosynthesis, and electroanalysis. GRA

N92-21334# David Sarnoff Research Center, Princeton, NJ.
FOUR-CHANNEL, HIGH-DYNAMIC-RANGE DOWNCONVERTER Final Report
R. E. Askew, R. W. Paglione, and E. J. Denlinger Nov. 1991 119 p
(Contract N00014-87-C-2495)
(AD-A245020) Avail: NTIS HC/MF A06 CSCL 09/1

The David Sarnoff Research Center has developed, under a 24-month Naval Research Laboratory sponsored program, a four-channel, high-dynamic-range down-converter (HDRD) that will advance the state of the art in electronic warfare receivers by achieving a two-tone, spur-free dynamic range of 65 dB in a 50-MHz bandwidth. A spot check of the linear dynamic range measured 92 dB from the noise floor to the 1 dB compression point. There are several design features that lead to these excellent results. They include: (1) the use of wideband, low-noise, high intercept point MMIC amplifier chips for all of the amplifiers in the downconverter; (2) low-loss MMIC PIN-diode switches; (3) low-loss filters and diplexers; and (4) a high-dynamic-range mixer. The input frequency range of the HDRD is 6 to 18 GHz, and the output frequency (IF) is 3 to 5 GHz. It uses four local oscillator (LO) frequencies, 11, 13, 15, and 17 GHz, to downconvert the six, 2-GHz-wide subbands to the intermediate frequency. A switched filter bank, consisting of six 2-GHz-wide bandpass filters, provides the required frequency selection for the downconverter. Each branch of the filter bank includes an amplitude and phase trimming module to allow for the adjustment of the tracking among the four channels. The trimming module consists of T-pad attenuator chips and an adjustable length of 50-ohm transmission line. GRA

N92-21349# Minnesota Univ., Minneapolis. Corrosion Research Center.
THIN FILM ELECTROCHEMICAL POWER CELLS Final Report
Boone B. Owens and William H. Smyrl 1991 8 p
(Contract N00014-88-K-0360)
(AD-A245176) Avail: NTIS HC/MF A02 CSCL 10/3

Fundamental properties of research cells were correlated with the projected performance of full scale power sources, considering both battery and supercapacitor concepts. In addition to establishing the data base for modelling and performance projections, the program had the additional objective of identifying loss mechanisms and degradation reactions, especially those unique to polymer thin film cell designs. Because of the intrinsic high electrode/electrolyte interface areas, interfacial reactions must be understood. Many applications require power under extreme conditions, and low temperature performance needs to be improved. GRA

N92-21351# Harry Diamond Labs., Adelphi, MD.
PROCESS ISSUES IN THE DEVELOPMENT OF A FERROELECTRIC CAPACITOR/CMOS TEST CHIP Progress Report, Oct. 1989 - Jan. 1991
Bernard J. Rod Dec. 1991 17 p

(AD-A245179; HDL-PR-91-2) Avail: NTIS HC/MF A03 CSCL 09/1

Processing details are discussed in the development of a procedure to fabricate lead-zirconate-titanate (PZT) ferroelectric capacitors on a CMOS test chip for purposes of electrical and radiation characterization studies. During the course of this work, several problems were encountered in the deposition and photoengraving of the platinum electrodes that form the conducting plates of the capacitor. Both dry and wet etching techniques were employed in an effort to define the top platinum electrodes. Solutions are discussed for those problems solved during this initial development phase. GRA

N92-21370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

PERFORMANCE OF A Y-Ba-Cu-O SUPERCONDUCTING FILTER/GaAs LOW NOISE AMPLIFIER HYBRID CIRCUIT

K. B. Bhasin, S. S. Toncich, C. M. Chorey, R. R. Bonetti, and A. E. Williams (Communications Satellite Corp., Clarksburg, MD.) 1992 5 p Proposed for presentation at the 1992 IEEE MTT-S International Microwave Symposium, Albuquerque, NM, 2-4 Jun. 1992

(Contract NAS3-25266)

(NASA-TM-105546; E-6869; NAS 1.26:105546) Avail: NTIS HC/MF A01 CSCL 09C

A superconducting 7.3 GHz two-pole microstrip bandpass filter and a GaAs low noise amplifier (LNA) were combined into an active circuit and characterized at liquid nitrogen temperatures. This superconducting/semiconducting circuit's performance was compared to a gold filter/GaAs LNA hybrid circuit. The superconducting filter/GaAs LNA hybrid circuit showed higher gain and lower noise figure than its gold counterpart. Author

N92-21422# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.

AUTOMATIC TRANSFORMATION OF TRANSISTOR ARRAYS IN FULL CUSTOM DESIGN Ph.D. Thesis [AUTOMATISCHE UMWANDLUNG VON TRANSISTORARRAYS IN VOLLKUNDEN-ENTWUERFEN]

Chao-Huang Wei 1991 125 p In GERMAN

(ETN-92-91150) Avail: NTIS HC/MF A06

It is shown that the array design can be quickly produced in small quantities or as a specimen for experimentation. The layout can be transformed into a circuit with high packing density. Two methods are presented. According to the first method, unused structures are eliminated, and compaction leads to full a custom design. The other method leads to a standard cell design. With regard to the geometric and electric properties of the array, this subdivision corresponds to the best approach for linear and digital arrays. ESA

N92-21435# National Inst. of Standards and Technology, Gaithersburg, MD. Electricity Div.

RESEARCH FOR ELECTRIC ENERGY SYSTEMS Annual Report, 1990

W. E. Anderson Jun. 1991 105 p

(PB92-112341; NISTIR-4691) Avail: NTIS HC/MF A06 CSCL 09B

The technical progress in four investigations which make up the project 'Support of Research Projects for Electrical Energy Systems,' funded by the U.S. Department of Energy and performed by the Electricity Division of the National Institute of Standards and Technology (NIST) is discussed. These investigations include measurements of magnetic fields in support of epidemiological and in vitro studies of biological field effects; development of a technique to measure trace amounts of S2F10 in the presence of SF6 and the development of an improved stochastic analyzer for pulsating phenomena; optical and electrical measurements of negative streamers preceding electric breakdown in liquid dielectrics; and the development of a reference resistive divider for high voltage impulse measurements. Author

N92-21451# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.

ELECTRONIC RELAXATION IN HYDROGENATED AMORPHOUS SILICON Ph.D. Thesis [ELEKTRONISCHE RELAXATION IM HYDROGENISIERTEN AMORPHEN SILIZIUM]

Detlef Herm 1991 188 p In GERMAN

(ETN-92-91147) Avail: NTIS HC/MF A09

The electronic properties of intrinsic and strongly doped hydrogenated amorphous silicon layers were examined using time resolution measurements of the photoinduced optical absorption and the microwave photoconductivity. Two comparison measurements were carried out for the same specimens using two measuring methods. The signal of photoinduced absorption contained information on the kinetics of trapped charge carrier while the signal of photoconductivity reflected the kinetics of the movable charge carrier. Both methods were complementary and allowed new insight into the electronic relaxation of hydrogenated amorphous silicon specimens. ESA

N92-21582# Sandia National Labs., Albuquerque, NM.

EXPERIMENTAL VERIFICATION OF THEORETICAL STRESS PREDICTIONS IN WOUND CAPACITORS

R. C. Reuter, Jr. and T. R. Guess 1991 6 p Presented at the 12th Capacitor and Resistor Technology Symposium, Tucson, AZ, 16-19 Mar. 1992

(Contract DE-AC04-76DP-00789)

(DE92-006555; SAND-91-2293C; CONF-920372-3) Avail: NTIS HC/MF A02

Residual stress states that are a direct result of fabrication and processing are known to exist inside wound capacitors. Considerable insights into the nature of these mechanical and thermomechanical stress states have been gained through the application of analytical prediction capabilities that have been developed for that purpose. For example, analysis shows where roll slip may occur in the capacitor due to steep wound tension gradients or low radial pressures, and how the tension loss of individual plies is distributed throughout the capacitor. Significant tension loss differences between dielectric and conducting plies has also been predicted, with conducting plies not only losing their initial winding tension, but actually experiencing a net compressive value of wound tension. While the results of these predictions are both quantitative and qualitative, only qualitative verification has been obtained thus far, such as visual observation of wrinkled conducting plies discovered in unwrapped capacitors. The purpose of this paper is to describe two experimental activities that were undertaken to support the analytical modeling effort and provide quantitative, experimental verification of some of the analysis predictions. DOE

N92-21597# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Signal Processing and Computer Technology.

COMPARISON OF DIGITAL FILTER ARCHITECTURES USING VHDL

P. Pitkaenen, J. Skyttae, and T. Laakso Jun. 1991 22 p

(PB92-133974; ISBN-95122-0690-0; Rept-7) Avail: NTIS HC/MF A03 CSCL 09C

VHSIC Hardware Description Language (VHDL) gives new possibilities for providing reliable cost estimates for computational architectures. VHDL was used for evaluating the cost efficiency of a class of different signal processing architectures. A set of digital filters having different specifications but equal noise characteristics were studied. Specifically, second order digital filter blocks using distributed arithmetic were studied. Part of the proposed architectures used error feedback in order to reduce roundoff noise. The architectures were modeled with VHDL in order to compare their mutual cost efficiency. Both a behavioral and a structural description of each architecture was written in order to ensure the correct operation of the design. Area and speed estimates were obtained based on the structural description. Author

N92-21749# National Inst. of Standards and Technology, Boulder, CO.
OPTIMIZATION TECHNIQUES FOR PERMITTIVITY AND PERMEABILITY DETERMINATION
P. D. Domich, J. Baker-Jarvis, and R. G. Geyer Jun. 1991 23 p
(PB92-112325; NISTIR-4571) Avail: NTIS HC/MF A03 CSCL 09C

Optimization techniques for the determination of complex permittivity and permeability in transmission lines are discussed. The traditional theoretical model using scattering parameters is extended into a mathematical regression model that can be solved with widely accepted numerical techniques. The new model produces accurate primary mode results for the samples tested, including nonmagnetic materials with high dielectric constants. An extention of the model includes responses due to higher order modes. The general model determines parameters to specify the spectral functional form of complex permittivity and permeability and is capable of small corrections to independent variable data, including angular frequency, sample length, sample position, and cutoff wavelength. Author

N92-21782# Northeast Semiconductor, Inc., Ithaca, NY.
INNOVATIVE TECHNIQUES FOR THE PRODUCTION OF LOW COST 2D LASER DIODE ARRAYS, SUPPLIES OR SERVICES AND PRICES/COSTS Monthly Report No. 2, 1-31 Dec. 1991
31 Dec. 1991 10 p
(Contract N00014-91-C-0222)
(AD-A244840) Avail: NTIS HC/MF A02 CSCL 09/3

The primary objective of this program is to develop a low cost, high yielding methodology for processing, packaging and characterization of MBE grown two-dimensional high power laser diode arrays. Projected increases in overall yield of A1GaAs diode lasers would reduce manufacturing cost from the current $10 to $20 per peak watt to below $3 per peak watt. Emphasis will be placed on innovative packaging techniques that will utilize recent advances in diamond heat sinking technology. Author (GRA)

N92-21796# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Energy Engineering.
MATHEMATICAL MODEL FOR METAL HYDRIDE ELECTRODES
M. Viitanen 1992 24 p
Avail: NTIS HC/MF A03 CSCL 09A

A model describing the discharge process of a metal hydride electrode is developed. An electrode is used as an anode in different types of electrochemical cells. The electrode studied is cylindrical; the metal hydride is in powdered form. In the model, the electrode consists of spherical particles with electrolytes between the particles. A special case of the model is considered to demonstrate the maximum current density which can be obtained from the metal hydride electrode, i.e. in the most favorable circumstances, where the only limiting factor is the diffusion of hydrogen in metal. Author

N92-21797# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Energy Engineering.
EXPERIMENTAL STUDY OF CYLINDRICAL AIR ELECTRODES
M. Viitanen, J. Lamminen, and M. J. Lampinen 1992 18 p
(PB92-136704) Avail: NTIS HC/MF A03 CSCL 09A

The electrodes studied here are cylindrical and prepared to be placed inside the inner surface of a sintered brass tube, which is nickel plated. The authors studied the long-term performance of these new cylindrical air electrodes and at the same time measured the carbonate content of the electrolyte. They have also analyzed by comparative methods which property of the electrode lowers the performance after a fairly long period. Author

N92-21807# Helsinki Univ. of Technology, Espoo (Finland). Circuit Theory Lab.
APLAC: AN OBJECT-ORIENTED ANALOG CIRCUIT SIMULATOR AND DESIGN TOOL. 5.3 REFERENCE MANUAL
M. Valtonen, A. Kankkunen, K. Mannersalo, R. Niutanen, and P. Stenius 15 Apr. 1991 329 p
(PB92-127141) Avail: NTIS HC/MF A15 CSCL 09C

Given here is a reference manual for the Analysis and design Program for mixed Lumped And distributed Circuits (APLAC). The main goal of the APLAC is to give the user full freedom in solving his/her problems without the restrictions of conventional simulators. The fifth generation version of APLAC gives special attention to the implementation of object orientation in C language and to microstrip component modeling. Author

N92-21808# Helsinki Univ. of Technology, Espoo (Finland). Circuit Theory Lab.
APLAC: AN OBJECT-ORIENTED ANALOG CIRCUIT SIMULATOR AND DESIGN TOOL. 5.3 USER'S MANUAL
M. Valtonen, A. Kankkunen, K. Mannersalo, R. Niutanen, and P. Stenius 15 Apr. 1991 229 p
(PB92-133446) Avail: NTIS HC/MF A11 CSCL 09C

A user's manual is given for the Analysis and design Program for mixed Lumped And distributed Circuits (APLAC). The main goal of APLAC is to give the user full freedom in solving his/her problems without the restrictions of conventional simulators. The fifth generation version of APLAC gives special attention to the implementation of object orientation in 'C'-language and to microstrip component modeling. Author

N92-21809# Helsinki Univ. of Technology, Espoo (Finland). Circuit Theory Lab.
APLAC: AN OBJECT-ORIENTED ANALOG CIRCUIT SIMULATOR AND DESIGN TOOL. 6.0 USER'S MANUAL
M. Valtonen, A. Kankkunen, K. Mannersalo, R. Niutanen, and P. Stenius 11 Oct. 1991 181 p
(PB92-134238) Avail: NTIS HC/MF A09 CSCL 09C

This serves as the user's manual for the Analysis Program for Linear Active Circuits (APLAC). The main goal of APLAC is to give the user full freedom in solving his/her problems without the restrictions of conventional simulators. The sixth generation of APLAC was created, having improved convergence algorithms for DC, transient and harmonic analyses, and improved menu-driven actions. Author

N92-21810# Helsinki Univ. of Technology, Espoo (Finland). Circuit Theory Lab.
APLAC: AN OBJECT-ORIENTED ANALOG CIRCUIT SIMULATOR AND DESIGN TOOL. 6.0 REFERENCE MANUAL
M. Valtonen, A. Kankkunen, K. Mannersalo, R. Niutanen, and P. Stenius 11 Oct. 1991 406 p
(PB92-134246) Avail: NTIS HC/MF A18 CSCL 09A

Given here is a reference manual for the Analysis Program for Linear Active Circuits (APLAC). The main goal of APLAC is to give the user full freedom in solving his/her problems without the restrictions of conventional simulators. The sixth generation of APLAC was created, having improved convergence algorithms for DC, transient, and harmonic analyses, and improved menu-driven actions. Author

N92-21824# Helsinki Univ. of Technology, Espoo (Finland). Digital Systems Lab.
DIALECTICAL NETS: A CATEGORICAL APPROACH TO NET THEORY
J. Lilius Nov. 1989 51 p
(PB92-134089; ISBN-951-22-0129-1; SER-B-8) Avail: NTIS HC/MF A04 CSCL 09C

A new approach to the modelling of net theory with tools from category theory called dialectical nets is reviewed. The main idea involves the use of the theory of generalized metric spaces to model the structure of a net. The arcs in a net are viewed as generalized relations between places and transitions. The category theoretical notion of adjunction is used to model the dialectical notion of opposing tendencies. The production and use of the net are modelled as an adjunct pair of functions. These functions are constructed from the generalized relations between the places and the transitions. Author

N92-21826# Helsinki Univ. of Technology, Espoo (Finland). Circuit Theory Lab.
DEVELOPMENT OF AN OPERATIONAL AMPLIFIER MACROMODEL FOR THE APLAC CIRCUIT SIMULATOR
P. Stenius Sep. 1991 32 p
(PB92-127158; ISBN-951-22-0764-8; CT-6) Avail: NTIS HC/MF A03 CSCL 09A

A study was made of the design and verification of an operational amplifier macromodel. The macromodel is designed using a build-up technique that takes advantage of the functional properties of the circuit design and simulation software Analysis Program for Linear Active Circuits (APLAC). It includes common non-ideal operational amplifier properties, such as frequency dependent open loop voltage gain, input and output resistance and capacitance, poles and zeroes in the transfer function, limited output voltage swing, finite positive and negative slew rate limitation, and common mode rejection ratio. The equations describing the operational amplifier are presented and derived. However, certain functions do appear ad hoc and are justified by simulation results only. Finally, simulation results on various configurations are presented. Author

N92-21827# National Inst. of Standards and Technology, Gaithersburg, MD. Semiconductor Electronics Div.
ELECTRONICS AND ELECTRICAL ENGINEERING LABORATORY TECHNICAL PUBLICATION ANNOUNCEMENTS COVERING LABORATORY PROGRAMS, APRIL TO JUNE 1991, WITH 1992 EEEL EVENTS CALENDAR
J. A. Gonzalez Dec. 1991 23 p
(PB92-133032; NISTIR-4736) Avail: NTIS HC/MF A03 CSCL 09C

Abstracts are provided by technical area for papers published this quarter. Major subject headings include fundamental electrical measurements, semiconductor microelectronics, signal acquisition, processing and transmission, and electrical systems. Author

N92-22042* National Aeronautics and Space Administration. Pasadena Office, CA.
ELECTROREPULSIVE ACTUATOR Patent
Earl R. Collins, Jr., inventor (to NASA) and Kenneth C. Curry, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 Jan. 1992 8 p Filed 30 Nov. 1989
(NASA-Case-NPO-17684-1-CU; US-Patent-5,084,645; US-Patent-Appl-SN-443522; US-Patent-Class-310-309; US-Patent-Class-310-308; Int-Patent-Class-H02N-1/08) Avail: US Patent and Trademark Office CSCL 09A

The invention is a linear actuator that operates under the principle that like charges repel and opposite charges attract. The linear actuator consists of first and second pairs of spaced opposed conductors where one member of each pair of conductors is attached to a fixed member, and where the other member of each pair of conductors is attached to a movable member such as an elongated rod. The two pairs of spaced conductors may be provided in the form of two spacedly interwound helical vanes where the conductors are located on the opposite sides of the two helical vanes. One helical vane extends inwardly from a housing and the other helical vane extends outwardly from an elongated rod. The elongated rod may be caused to move linearly with respect to the housing by applying appropriate charges of like or opposite polarity to the electrical conductors on the helical vanes.
Official Gazette of the U.S. Patent and Trademark Office

N92-21302*# Mercer Univ., Macon, GA. Dept. of Biomedical Engineering.
AN INVESTIGATIVE REDESIGN OF THE ECG AND EMG SIGNAL CONDITIONING CIRCUITS FOR TWO-FAULT TOLERANCE AND CIRCUIT IMPROVEMENT Final Report
Edward M. OBrien *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09C

N92-22095# National Space Development Agency, Tokyo (Japan). Parts and Material Lab.
THE ENGINEERING SOLUTIONS TO THE PROBLEM OF SPACE RADIATION EFFECTS IN SEMICONDUCTOR DEVICES
Tateo Goka and Sigeru Ikeda *In its* Preprints of NASDA's 5th Technical Symposium 1 Jun. 1990 p 159-187 In JAPANESE; ENGLISH summary (For primary document see N92-22089 12-12)
Avail: NTIS HC/MF A09

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N92-21171# Oregon State Univ., Corvallis.
EFFECTS OF PRESSURE ON MEMBRANE-ASSOCIATED RECEPTORS AND EFFECTOR ELEMENT Final Report
Thomas F. Murray 31 May 1991 2 p
(Contract N00014-89-J-1869)
(AD-A245220) Avail: NTIS HC/MF A01 CSCL 20/4

To investigate the effects of moderate hydrostatic pressures on signal transduction we have used the A (1) adenosine receptor inhibitory G protein (Gi) - adenylyl cyclase system in two species of sorpaenid fish which have served as a model for the study of pressure adaptation. These species, Sebastolobus alascanus and S. Altivelis, have similar body temperatures, but dwell at different depths, and thus experience different hydrostatic pressures. The experiments were designed to identify and define at the molecular level the effects of pressure on the components of the signal transduction system in isolation and on the entire functional complex. We have completed work characterizing the effects of pressure on the coupling efficiency of the A (1) adenosine receptor in brain membrane preparations. For the teleost brain membrane preparations, incubation at 5 C and 476 atm does not result in loss of adenylyl cyclase activity or coupling to the A (1) adenosine receptor on subsequent assays at atmospheric pressure. In contrast, rat brain membrane preparations lost 59 pct. of their activity under these conditions. GRA

N92-21192*# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FLUID MECHANICS EXPERIMENTS IN OSCILLATORY FLOW. VOLUME 2: TABULATED DATA Final Report
J. Seume, G. Friedman, and T. W. Simon Mar. 1992 184 p
(Grant NAG3-598)
(NASA-CR-189128; NAS 1.26:189128) Avail: NTIS HC/MF A09 CSCL 20D

Results of a fluid mechanics measurement program in oscillating flow within a circular duct are presented. The program began with a survey of transition behavior over a range of oscillation frequency and magnitude and continued with a detailed study at a single operating point. Such measurements were made in support of Stirling engine development. Values of three dimensionless parameters, Re sub max, Re sub w, and A sub R, embody the velocity amplitude, frequency of oscillation, and mean fluid displacement of the cycle, respectively. Measurements were first made over a range of these parameters that are representative of the heat exchanger tubes in the heater section of NASA's Stirling cycle Space Power Research Engine (SPRE). Measurements were taken of the axial and radial components of ensemble-averaged velocity and rms velocity fluctuation and the dominant Reynolds shear stress, at various radial positions for each of four axial stations. In each run, transition from laminar to turbulent flow, and its reverse, were identified and sufficient data was gathered to propose the transition mechanism. Volume 2 contains data reduction program listings and tabulated data (including its graphics). Author

N92-21193# Argonne National Lab., IL.
TWO-PHASE FLOW AND PRESSURE DROP IN FLOW PASSAGES OF COMPACT HEAT EXCHANGERS
M. W. Wambsganss, J. A. Jendrzejczyk, and D. M. France 1992 31 p Presented at the 1992 Society of Automotive Engineers (SAE) International Congress and Exposition, Detroit, MI, 24-28 Feb. 1992
(Contract W-31-109-eng-38)
(DE92-006996; ANL/CP-74646; CONF-920233-2) Avail: NTIS HC/MF A03

Two-phase flow experiments were performed with air/water mixtures in a small rectangular channel measuring 9.52 x 1.59 mm (aspect ratio equal to 6), for applications to compact heat exchangers. Pressure drop and flow pattern definition data were obtained over a large range of mass qualities (0.0002 to 1), and in the case of flow pattern data, a large range of mass fluxes (50 to 2,000 kg/m(exp 2)s). A flow pattern map, based on visual observations and photographs of the flow patterns, is presented and compared with a map developed for a rectangular channel of the same aspect ratio but with dimensions twice those of the test channel, and with a map developed for a circular tube with the same hydraulic diameter of 3 mm. Pressure drop data are presented as a function of both mass quality and Martinelli parameter and are compared with state-of-the-art correlations and a modified Chisholm correlation. DOE

N92-21196# Pittsburgh Energy Technology Center, PA.
SOME REMARKS ON THE MODELING OF FLUID-SOLID SYSTEMS
M. Massoudi, J. M. Ekmann, M. P. Mathur, and K. R. Rajagopal (Pittsburgh Univ., PA.) Jan. 1992 15 p
(DE92-007037; DOE/PETC-TR/92/4) Avail: NTIS HC/MF A03

Multiphase flows have increasingly become the subject of considerable attention because of their importance in many industries such as fluidized beds, pneumatic transport of solids, coal combustion, etc. Much work has been reported in the literature about the mathematical modeling of multicomponent systems. The two foremost approaches use either an averaging technique or the theory of interacting continua (theory of multiphase mixtures). In both methods, constitutive relations are needed for the stress tensors for each constituent, the interaction force, etc. However, other researchers have postulated governing equations, based on a generalization of the hydrodynamics involving the flow past a single particle. In this short note we discuss an apparent discrepancy in the approach of some of these researchers. We point out that their theory is quite insensitive to the values of some of the material parameters that appear in their equations. We also observe that the values that they have used for the material parameters have been based on experimental work retracted as being incorrect by the experimentalists. Correlating with the corrected experimental work can lead to significantly different values for the material parameters than those reported. DOE

N92-21223# Phillips Lab., Kirkland AFB, NM.
THE VAN LEER ADVECTION ALGORITHM IN THE MACH2 COMPUTER CODE Final Report, 1 Dec. 1989 - 31 May 1991
Carl R. Sovinec Aug. 1991 45 p
(AF Proj. 5797)
(AD-A244509; AD-E200822; PL-TR-91-1051) Avail: NTIS HC/MF A03 CSCL 20/4

The van Leer advection algorithm has been added to the two dimensional magnetohydrodynamics code, MACH2. The mathematical theory and the implementation for nonmagnetic quantities are discussed. One dimensional test problems are presented to compare this algorithm with the Godunov advection algorithm, which was previously used in MACH2. The new implementation induces less smoothing on advected discontinuities, while maintaining the monotonic property of cell-centered distributions. A special treatment of the momentum advection is required to maintain a monotonic velocity distribution. The net practical result is a substantial savings on computational time as the van Leer algorithm requires less resolution to achieve the same level of convergence as the Godunov algorithm for dynamic problems. GRA

N92-21232# Duisburg Univ. (Germany, F.R.).
BOUNDARY LAYER FLOW IN AXIAL COMPRESSORS (THEORETICAL PART) Interim Report No. 1, Jan. 1985 - Sep. 1985 [RANDZONENSTROEMUNG IN AXIALVERDICHTERN (THEORETISCHER TEIL). 1: ZWISCHENBERICHT, JAN. 1985 - SEP. 1985]
H.-J. Dohmen 1985 69 p In GERMAN
(Contract T/RF42/E0013/E1413)
(ETN-92-91006) Avail: NTIS HC/MF A04

The development of a computational process for solving parabolic flow problems is examined. The solution algorithm presented is checked for very simple geometries. It shows satisfactory results for a straight orthogonal channel. ESA

N92-21233# Duisburg Univ. (Germany, F.R.). Fachbereich Maschinenbau.
BOUNDARY LAYER FLOW IN AXIAL COMPRESSORS (THEORETICAL PART) Interim Report No. 2, Oct. 1985 - Mar. 1986 [RANDZONENSTROEMUNG IN AXIALVERDICHTERN (THEORETISCHER TEIL). 2: ZWISCHENBERICHT, OCT. 1985 - MAR. 1986]
H.-J. Dohmen and M. Janssen 1986 43 p In GERMAN
(Contract T/RF42/E0013/E1413)
(ETN-92-91007) Avail: NTIS HC/MF A03

It is shown that the transition from simple geometries to an actual compressor geometry is possible using a transformation which maps the actual compressor geometry on an orthogonal computation field. The theoretical principles of such a transformation and the development of a 'computation aided net generator' are explained. Test computations were carried out for controlling the transformation. The results are presented for a curved channel of constant cross section. ESA

N92-21234# Duisburg Univ. (Germany, F.R.). Fachbereich Maschinenbau.
BOUNDARY LAYER FLOW IN AXIAL COMPRESSORS (THEORETICAL PART) Final Report, Jan. 1985 - Dec. 1986 [RANDZONENSTROEMUNG IN AXIALVERDICHTERN (THEORETISCHER TEIL). ABSCHLUSSBERICHT, JAN. 1985 - DEC. 1986]
H.-J. Dohmen and M. Janssen 1986 97 p In GERMAN
(Contract T/RF42/E0013/E1413)
(ETN-92-91008) Avail: NTIS HC/MF A05

A general differential equation is introduced into a set of conservation equations. The mathematical reprocessing of the fundamental equations for the numerical process is represented using this equation. The transformation of the equation into a general curvilinear coordinate system is explained in detail. The theoretical principles that are necessary for the automatization of the process of net generation are presented. Difficulties associated with net generation are discussed. The solution algorithm for the numerical simulation of flow computation is presented. The algorithm for net generation transformation and flow computation is explained using flow schemes. ESA

N92-21248*# Vigyan Research Associates, Inc., Hampton, VA.
HEAT TRANSFER FROM CYLINDERS IN SUBSONIC SLIP FLOWS
K. A. Nagabushana and P. C. Stainback Washington NASA Feb. 1992 241 p Prepared in cooperation with Analytical Services and Materials, Inc., Hampton, VA
(Contracts NAS1-18585; NAS1-19320)
(NASA-CR-4429; NAS 1.26:4429) Avail: NTIS HC/MF A11 CSCL 20D

The heat transfer in heated wires was measured using a constant temperature anemometer over a Mach number range from 0.05 to 0.4 and pressures from 0.5 to 8.0 atmospheres. The total temperature ranged from 80 to 120 F and the wire diameters were 0.00015, 0.00032, and 0.00050 inch. The heat transfer data

is presented in the form of a corrected Nusselt number. Based on suggested criteria, much of the data was obtained in the slip flow regime. Therefore, the data is compared with data having comparable flow conditions. The possible application of the heat transfer data to hot wire anemometry is discussed. To this end, the sensitivity of the wires to velocity, density, and total temperature is computed and compared using two different types of correlations. Author

N92-21262*# Sverdrup Technology, Inc., Brook Park, OH.
INTERFACIAL TENSION MEASUREMENT OF IMMISCIBLE LIQ UIDS USING A CAPILLARY TUBE
N. Rashidnia, R. Balasubramaniam, and D. DelSignore (Toledo Univ., OH.) Mar. 1992 10 p
(Contract NAS3-25266)
(NASA-CR-189133; E-6918; NAS 1.26:189133) Avail: NTIS HC/MF A02 CSCL 20D

The interfacial tension of immiscible liquids is an important thermophysical property that is useful in the behavior of liquids both in microgravity (Martinez et al. (1987) and Karri and Mathur (1988)) and in enhanced oil recovery processes under normal gravity (Slattery (1974)). Many techniques are available for its measurement, such as the ring method, drop weight method, spinning drop method, and capillary height method (Adamson (1960) and Miller and Neogi (1985)). Karri and Mathur mention that many of the techniques use equations that contain a density difference term and are inappropriate for equal density liquids. They reported a new method that is suitable for both equal and unequal density liquids. In their method, a capillary tube forms one of the legs of a U-tube. The interfacial tension is related to the heights of the liquids in the cups of the U-tube above the interface in the capillary. Our interest in this area arose from a need to measure small interfacial tension (around 1 mN/m) for a vegetable oil/silicon oil system that was used in a thermocapillary drop migration experiment (Rashidnia and Balasubramaniam (1991)). In our attempts to duplicate the method proposed by Karri and Mathur, we found it quite difficult to anchor the interface inside the capillary tube; small differences of the liquid heights in the cups drove the interface out of the capillary. We present an alternative method using a capillary tube to measure the interfacial tensions of liquids of equal or unequal density. The method is based on the combined capillary rises of both liquids in the tube. Author

N92-21297# Naval Postgraduate School, Monterey, CA.
LASER VELOCIMETRY MEASUREMENTS OF OSCILLATING AIRFOIL DYNAMIC STALL FLOW FIELD
M. S. Chandrasekhara Jun. 1991 14 p Presented at the 22nd AIAA Fluid Dynamics, Plasma Dynamics, and Lasers Conference, Honolulu, HI, 24-26 Jun. 1991 Previously announced in IAA as A91-43648
(Contract MIPR-ARO-114-91)
(AD-A244546; ARO-27894.6-EG) Avail: NTIS HC/MF A03 CSCL 01/1

The phenomenon of dynamic stall is an important case of forced unsteady separated flow and is of great importance to both helicopters and fixed wing aircraft. Ensemble averaged two component velocity measurements over an airfoil experiencing oscillatory dynamic stall under compressibility conditions were obtained. The measurements show the formation of a separation bubble over the airfoil that persists till angles of attack close to when the dynamic stall vortex forms and convects. The fluid attains mean velocities as large as 1.6 times the free stream velocity (FSV) with instantaneous values of 1.8 fsv. The airfoil motion induces these large velocities in regions that are far removed from its surface. Also, depending upon the behavior of the separation bubble, the wall jet profiles near the leading edge region could become wake like over the airfoil in a cycle at different phase angles. Vorticity contours indicate that the levels around the leading edge continuously increase till the vortex begins to convect. Some of the measurement difficulties, especially particle behavior, are discussed as well. GRA

N92-21342*# Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.
ELEMENTS OF RADIATIVE INTERACTIONS IN GASEOUS SYSTEMS Supplementary Report, period ending Nov. 1991
Surendra N. Tiwari Dec. 1991 198 p
(Grant NAG1-423)
(NASA-CR-189922; NAS 1.26:189922) Avail: NTIS HC/MF A09 CSCL 20D

Basic formulations, analyses, and numerical procedures are presented to study radiative interactions in gray as well as nongray gases under different physical and flow conditions. After preliminary fluid-dynamical considerations, essential governing equations for radiative transport are presented that are applicable under local and nonlocal thermodynamic equilibrium conditions. Auxiliary relations for relaxation times and spectral absorption model are also provided. For specific applications, several simple gaseous systems are analyzed. The first system considered consists of a gas bounded by two parallel plates having the same temperature. For this system, both vibrational nonequilibrium effects and radiation conduction interactions are studied. The second system consists of fully developed laminar flow and heat transfer in a parallel plate duct under the boundary condition of a uniform surface heat flux. For this system, effects of gray surface emittance are studied. With the single exception of a circular geometry, the third system is identical to the second system. Here, the influence of nongray walls is also studied, and a correlation between the parallel plates and circular tube results is presented. The particular gases selected are CO, CO2, H2O, CH4, N2O, NH3, OH, and NO. The temperature and pressure range considered are 300 to 2000 K, and 0.1 to 100 atmosphere, respectively. Illustrative results obtained for different cases are discussed and some specific conclusions are provided. Author

N92-21367# Naval Postgraduate School, Monterey, CA.
COMPUTATIONAL UNSTEADY FLOW DYNAMICS: OSCILLATING FLOW ABOUT A CIRCULAR CYLINDER M.S. Thesis
David R. Gordon Dec. 1991 115 p
(AD-A245144) Avail: NTIS HC/MF A06 CSCL 20/4

The numerical experiments, carried out through the use of the vorticity-stream function equations and their finite difference form, on coexisting flows (sinusoidal or nonsinusoidal oscillation plus steady mean flow) are described. A third order in time, second order in space, three-level predictor-corrector finite difference scheme has been used. The Poisson equation for the stream function was solved by a Fast Poisson Solver based on the High Order Difference Approximation with Identity Expansion (HODIE) and the Fast Fourier Transform (FFT) methods provided by the IMSL mathematical library. The results have revealed, for the first time, the existence of a very interesting wake comprised of three rows of heterostrophic vortices at certain Keulegan-Carpenter numbers and relative current ratios. The existence of such a street has been vindicated by physical experiments. GRA

N92-21405*# Worcester Polytechnic Inst., MA.
ROTATIONAL FLUID FLOW EXPERIMENT: WPI/MITRE ADVANCED SPACE DESIGN GASCAN 2
Walter F. Daly, Lee Harr, Rocco Paduano, Tony Yee, Eddy Eubbani, Jaime DelPrado, and Ajay Khanna 30 Apr. 1991 143 p
(Contract NASw-4435)
(NASA-CR-189979; NAS 1.26:189979) Avail: NTIS HC/MF A07 CSCL 20D

The design and implementation is examined of an electro-mechanical system for studying vortex behavior in a microgravity environment. Most of the existing equipment was revised and redesigned as necessary. Emphasis was placed on the documentation and integration of the mechanical and electrical subsystems. Project results include the reconfiguration and thorough testing of all the hardware subsystems, the implementation of an infrared gas entrainment detector, new signal processing circuitry for the ultrasonic fluid circulation device, improved prototype interface circuits, and software for overall control of experiment design operation. Author

N92-21415 Princeton Univ., NJ.
A VARIABLE PRESSURE FLOW REACTOR FOR CHEMICAL KINETIC STUDIES: HYDROGEN, METHANE AND BUTANE OXIDATION AT 1 TO 10 ATMOSPHERES AND 880 TO 1,040 K Ph.D. Thesis
Michael Louis Vermeersch 1991 254 p
Avail: Univ. Microfilms Order No. DA9202524

A variable pressure flow reactor (VPFR) for studies of combustion chemical kinetics was designed, implemented, and validated. This installation is capable of experiments at pressures from 1 to 28 atm, initial temperatures as high as 1300 K and test times from 0.060 to several seconds. Experiments were performed with a dilute mixture of hydrogen and oxygen in nitrogen (0.01 : 0.05: 0.985, H2 : O2 : N2). The initial conditions were 863 K at 1.0 atm, 916 K at 3.0 atm, 945 K at 6.0 atm and 970 K at 9 atm. The reaction times studied ranged from 0.04 seconds to over 1 second. Experimental measurements of hydrogen oxygen ignition delay times obtained in the VPFR are consistent with those reported in shock tubes studies and other flow tube studies. These hydrogen-oxygen experiments were compared to predictions based on a recently published mechanism of Yetter et al. The model predictions of the extended second explosion limit at 1 and 3 atm agreed with the experimental measurements. The model predictions of slow reaction profiles (reaction profiles at conditions located between the extended second explosion limit and the third explosion limit), but good agreement was obtained for fast reaction profiles at 1 atm. However, the experimental measurements of ignition delay time were more that two orders of magnitude less than model predictions at 1 atm and 862 K. Agreement was better at higher temperatures and pressures. Dissert. Abstr.

N92-21428 Princeton Univ., NJ.
THE EVOLUTION OF LARGE AMPLITUDE DISTURBANCES IN PLANAR COUETTE FLOW Ph.D. Thesis
Gerald Frederick Syms 1991 205 p
Avail: Univ. Microfilms Order No. DA9202540

The evolution of large amplitude disturbances in planar Couette flow is studied with a new algorithm for solving numerically the incompressible 3-D unsteady Navier-Stokes equations. The method uses primitive variables on a staggered grid or equivalently, a finite volume approach. The momentum equations are advanced in time by an iterative process for the nonlinearity yielding a second order accurate scheme. All iterates are kept divergence free by solving a Poisson equation for the pressure. Neumann boundary conditions are used such that the momentum iterates also satisfy the velocity boundary conditions. The Poisson equation is solved iteratively being accelerated by a multigrid scheme. The initial conditions are found by mapping an arbitrary nonsolenoidal velocity potential. The potential field is found by solving a Poisson equation analogous to the pressure equation. Three cases of a unit streamwise velocity impulsive disturbance and one case of two such superposed disturbances are studied. The first three take the initial perturbation and place it near the bottom plate, with and without the linear background velocity profile, and midway between the plates with the uniform shear flow. The velocity and vorticity fields develop according to the pressure field which consists of a spanwise low formation surrounded by local streamwise highs. The vorticity field includes a distinct set of vortical loops. The downstream portion of the disturbance evolves slowly in time as the associated high pressure region dissipates quickly. The upstream section undergoes several phases of evolution as the pressure field repeatedly generates similar structures. The two disturbances show a local region of influence but remain mostly well defined. Dissert. Abstr.

N92-21430 Minnesota Univ., Minneapolis.
STUDIES IN TWO-PHASE SOLID-LIQUID FLOWS Ph.D. Thesis
Pushpendra Singh 1991 122 p
Avail: Univ. Microfilms Order No. DA9202846

A definition of the solid fraction which takes into account the finite size of particles is proposed. From this definition a mass balance for finite size spheres of radius R is derived. The ill-posed problem which arises in the study of stability of the state of uniform fluidization is regularized by the finite size effect, even in the zeroth order theory in which derivatives of the solids fraction and the particles velocity in the momentum balance are neglected. In this case, the growth rate of unstable waves is zero for a countably infinite set of blocked wave numbers, alpha's, alpha = 0, 4.493/R, 7.725/R, ..., infinity. Between two such alpha values the growth rate attains a maximum, the magnitude of which decreases with alpha. The nature of voidage fluctuations in 2-D fluidized beds is studied using a high speed motion analysis system. Analysis of digitized pictures gives the solids fraction as a function of space and time at a discrete set of points. The temporal changes at a point are found to be chaotic. Analysis of chaotic and dispersive wave like structures is carried out with the aid of 2-D spectra depending on a frequency and wave number. The power spectrum computed experimentally for the spatial solids fraction distribution also looks like the graph of the growth rate as a function of alpha with minimum power at the zeros of the growth rate function. As the Reynolds number increases the graph of the power spectrum gets distorted so as to have larger energy at smaller wave numbers. This distortion can be explained by wave effects which make horizontal configurations more stable. The stability of such horizontal configurations is studied by a direct numerical simulation of the Navier-Stokes equations. Dissert. Abstr.

N92-21450# Rolls-Royce Ltd., Derby (England).
THE DIRECT DEPOSITION OF MULTIPLE HOT FILM SENSORS ONTO A TURBINE NGV USING THIN FILM PROCESSING TECHNIQUES
S. C. P. Cook, T. Kunikyo, and J. Shinohara (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan) 1 Sep. 1991 9 p Sponsored in part by Fellowship of Engineering
(PNR-90861; ETN-92-90803) Copyright Avail: NTIS HC/MF A02

Multiple hot film sensors were directly deposited, as thin films, onto research turbine Nozzle Guide Vanes (NGV) to monitor the state of the vane boundary layers under low Reynolds number conditions. The sensors were fabricated using thin film processing techniques, including coating the vanes with an organic insulator, vacuum deposition of metals, and ceramic and photolithography. A method of depositing a thin film of polyimide directly onto the entire surface area of a component was perfected. The nominal thickness is 3 micrometers and this acts as a thermal and electrical insulator. By employing suitable vacuum deposition techniques a thin film construction of sensors and lead out tracks can then be produced within a thickness of a further 2 micrometers. The direct fabrication of hot film sensors onto the vanes represents a very significant advance, since complex three dimensional recesses do not need to be machined into the vane surface. The instrumented vanes were built into an annular cascade and run in a cold flow turbine test facility. The hot film sensors exhibited excellent characteristics, and selected turbine rig test results are included to show the quality of the data obtained. ESA

N92-21498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EFFECT OF LIQUID SURFACE TURBULENT MOTION ON THE VAPOR CONDENSATION IN A MIXING TANK
C. S. Lin (Analex Corp., Brook Park, OH.) and M. M. Hasan Jul. 1991 14 p Presented at the Fourth International Symposium on Transport Phenomena in Heat and Mass Transfer, Sydney, Australia, 14-19 Jul. 1991; sponsored by Univ. of New South Wales
(Contract NAS3-25726)
(NASA-TM-105555; E-6152; NAS 1.15:105555) Avail: NTIS HC/MF A03 CSCL 20D

The effect of liquid surface motion on the vapor condensation in a tank mixed by an axial turbulent jet is numerically investigated. The average value (over the interface area) of the root-mean-squared (rms) turbulent velocity at the interface is shown to be linearly increasing with decreasing liquid height and increasing jet diameter for a given tank size. The average rms turbulent velocity is incorporated in Brown et al. (1990) condensation

correlation to predict the condensation of vapor on a liquid surface. The results are in good agreement with available condensation data. Author

N92-21552# Los Alamos National Lab., NM.
INTERMITTENCY GROWTH IN 3D TURBULENCE
Y. Kimura 1991 13 p Presented at the Research Conference on Topological Fluid Dynamics, Santa Barbara, CA, 1-5 Nov. 1991
(Contract W-7405-eng-36)
(DE92-007712; LA-UR-92-149; CONF-911127-1) Avail: NTIS HC/MF A03

Recently increasing attention has been paid to the non-Gaussian properties of small scales in turbulent flows as a manifestation of intermittency. Past numerical studies were, however, almost always restricted to simulations with external forces or to results after several eddy-turn-over times. This is because the equilibrium shapes of the Probability Density Functions (PDFs) of velocity and velocity gradients were the main concern. As a theoretical tool to analyze non-Gaussianity, Kraichnan and his co-workers developed a systematic technique called mapping closure. The working hypothesis of the technique is that the shape of PDF is determined by a balance between advection which produces active small eddies and dissipation which wipes them out. At these processes have different time scales, different shapes of PDF are possible as a result of combinations of the processes. Accurate statistical calculations for decaying turbulence with the initial Gaussian distribution is vital, in the examination of the hypothesis. In this article, we shall present numerical results on the development of the shape of PDFs of the velocity components and transverse velocity gradients of Navier-Stokes turbulence. The possibility of controlling intermittency will be discussed. We used three-dimensional pseudospectral simulations with 64(sup 3) periodic grid points. To get clean statistical information, averages over a large number of ensembles of different initial conditions satisfying the same energy spectrum were taken. DOE

N92-21699# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (Germany, F.R.). Abt. Antriebsintegration.
EXTENSION OF A THREE DIMENSIONAL EULER-CODE FOR THE INVESTIGATION OF THE FLOW FIELD AROUND BYPASS ENGINES WITH FAN AND CORE JET Thesis - Technische Univ.
Ralf Rudnik Nov. 1990 113 p In GERMAN; ENGLISH summary
(DLR-FB-91-13; ISSN-0171-1342; ETN-92-90732) Avail: NTIS HC/MF A06; DLR, Wissenschaftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 37.50 DM

An existing finite volume scheme for the discretization of the three dimensional Euler equations is extended by including the core jet flow field. The modifications are described, with special regard to grid generation and the numerical algorithm. Flow calculations of a typical high bypass engine are performed for takeoff and cruise conditions, under consideration of real operational jet parameters. Several variations of the jet pressure and temperature ratio are presented. The influence of numerical parameters on the solution in the region of the jet flow is analyzed by varying the coefficient of the artificial dissipation and the grid density. ESA

N92-21704# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Hubschrauber und Flugzeuge.
ENHANCED NUMERICAL INVISCID AND VISCOUS FLUXES FOR CELL CENTERED FINITE VOLUME SCHEMES
Albrecht Eberle Jul. 1991 10 p Presented at the 4th International Symposium on Computational Fluid Dynamics, Davis, CA, 9-12 Sep. 1991
(MBB-FE-211/S/PUB/458/0; ETN-92-90999) Copyright Avail: NTIS HC/MF A02

The most attractive features of cell centered finite volume schemes seem to be the easy introduction of the solid body boundary condition and the implementation of characteristic based methods for evaluating the convective fluxes at the cell faces of the finite volumes. For the viscous parts of the fluxes, however, cell centered finite volume schemes are not as well suited as cell vertex based discretizations since in a general grid, cell centered schemes usually are not linear flow preserving concerning the viscous terms. That means that the viscous stress tensor and the heat flux vector may spuriously vary in a flow field with linear velocity and/or temperature distribution. Several enhancements of the flux formulations for cell centered finite volume schemes are described. ESA

N92-21724* National Aeronautics and Space Administration. Pasadena Office, CA.
ADJUSTABLE STEAM PRODUCING FLEXIBLE ORIFICE INDEPENDENT OF FLUID PRESSURE Patent
Andrew D. Morrison, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 14 Jan. 1992 7 p Filed 31 May 1990 Supersedes N90-27070 (28 - 21, p 3003)
(NASA-Case-NPO-17625-1-CU; US-Patent-5,080,286; US-Patent-Appl-SN-531434; US-Patent-Class-239-533.13; US-Patent-Class-239-543; US-Patent-Class-239-546; US-Patent-Class-239-552; US-Patent-Class-239-602; Int-Patent-Class-B05B-1/02; Int-Patent-Class-B05B-1/14) Avail: US Patent and Trademark Office CSCL 20D

A self-adjusting choke for a fluids nozzle includes a membrane constructed of a single piece of flexible or elastic material. This flexible material is shaped to fit into the outlet of a nozzle. The body of the membrane has at least two flow channels, from one face to the other, which directs two streams of water to cross at the opening of the nozzle or at some point beyond. The elasticity and thickness of the membrane is selected to match the range of expected pressures and fluid velocities. The choke may have more than two flow channels, as long as they are aligned adjacent to one another and directed towards each other at the exit face. In a three orifice embodiment, one is directed upward, one is directed downward, and the one in the middle is directed forward. In this embodiment all three fluid streams intersect at some point past the nozzle opening. Under increased pressure the membrane will deform causing the orifices to realign in a more forward direction, causing the streams to intersect at a smaller angle. This reduces the force with which the separate streams impact each other, still allowing the separate streams to unify into a single stable spiralling stream in spite of the increased pressure.
Official Gazette of the U.S. Patent and Trademark Office

N92-21742# Rolls-Royce Ltd., Derby (England). Theoretical Science Group.
PRACTICAL APPLICATION OF 3-D CFD METHODS TO GAS TURBINE COMBUSTORS
John Coupland 1 Aug. 1990 25 p Presented at the Cranfield Gas Turbine Combustion Course, England, 6 Jul. 1990
(PNR-90773; ETN-92-90763) Copyright Avail: NTIS HC/MF A03

The objective of the application of three dimensional Computation Fluid Dynamics (CFD) methods is to assist the design and development process by proving reasonable predictions of combustor flows at a reasonable cost and in a reasonable time. Some of the features that have to be considered in a practical CFD system, are described and some idea of the sort of problems being tackled on the gas turbine industry using these methods is given. Specifically the following are covered: mesh generation techniques, boundary conditions, turbulence modeling, combustion modeling, output display, combustor flow applications, some other geometries of interest, future developments. ESA

N92-21763# Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.
VORTEX MOTION IN ROTATING SUPERFLUID He-3-B
E. B. Sonin, Y. Kondo, J. S. Korhonen, and M. Krusius 23 May 1991 20 p
(PB92-134162; ISBN-951-22-0648-X) Avail: NTIS HC/MF A03 CSCL 20D

Using nuclear magnetic resonance (NMR) techniques, two

modes in the temporal response of B-phase vortices were observed: (1) a large readjustment of vortex density occurs in about 10 sec; and (2) small changes near equilibrium are associated with exponentially damped relaxation of about 1-4 min. The latter represents an overdamped collective mode of the vortex array, governed by elasticity and pinning. As in superconductors, at large vortex density, pinning becomes a collective effect, reflecting the rigidity of the ordered vortex lattice. GRA

N92-21984# Sheffield Univ. (England). Dept. of Automatic Control and Systems Engineering.
IMPROVED WAVE FORCE CLASSIFICATION, USING SYSTEM IDENTIFICATION
P. K. Stansby, K. Worden, G. R. Tomlinson (Manchester Univ., England), and S. A. Billings Oct. 1991 39 p Sponsored by United Kingdom Dept. of Energy Marine Technology Directorate (RR-440; ETN-92-91094) Avail: NTIS HC/MF A03

An extension to the Morison equation including Duffing oscillator type force terms is postulated through knowledge of the flow mechanisms. This is used to curve fit measured force time histories for velocity time histories, generated experimentally from various sources: regular oscillatory flow in a U tube, cylinder oscillation in still water and in a current, random waves in wave flume, and a directional sea state. In unidirectional flows the association of a significant history term with vortex shedding is confirmed by the occurrence of a prominent transverse or lift force. In directional seas, lift (due to vortex shedding) cannot be isolated and it is suggested that the data analysis described will indicate the significance of vortex shedding through the relative magnitude of the history term. ESA

N92-21275*# Texas Univ., San Antonio. Div. of Engineering.
A LOCAL CONDENSATION ANALYSIS REPRESENTING TWO-PHASE ANNULAR FLOW IN CONDENSER/RADIATOR CAPILLARY TUBES Final Report
Amir Karimi *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 20D

N92-21685# Aerospatiale, Toulouse (France). Div. Avions.
METHOD FOR CALCULATING THE THREE-DIMENSIONAL WATER CONCENTRATION COEFFICIENTS AND ITS INDUSTRIAL APPLICATIONS [METHODE DE CALCUL DE COEFFICIENTS DE CONCENTRATION D'EAU EN TRIDIMENSIONNEL ET SES APPLICATIONS INDUSTRIELLES]
P. Prel *In* AGARD, Effects of Adverse Weather on Aerodynamics Dec. 1991 12 p In FRENCH (For primary document see N92-21679 12-03)
Copyright Avail: NTIS HC/MF A13; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21953# Naval Postgraduate School, Monterey, CA. Dept. of Aeronautics and Astronautics.
THE AERODYNAMICS OF SHIP SUPERSTRUCTURES
J. V. Healey *In* AGARD, Aircraft Ship Operations Nov. 1991 14 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21954# Naval Air Test Center, Patuxent River, MD. Rotary Wing Aircraft Test Directorate.
SHIP AIRWAKE MEASUREMENT AND MODELING OPTIONS FOR ROTORCRAFT APPLICATIONS
Dean Carico, Bill Reddy, and Charles DiMarzio (Northeastern Univ., Boston, MA.) *In* AGARD, Aircraft Ship Operations Nov. 1991 24 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N92-21955# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
MEASUREMENT OF THE FLOW DISTRIBUTION OVER THE FLIGHT DECK OF AN AIRCRAFT CARRIER
M. Mulero and F. Gomez Portabella *In* AGARD, Aircraft Ship Operations Nov. 1991 12 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N92-21199# Pacific Northwest Lab., Richland, WA.
FIBER-OPTIC INTERFEROMETRIC SENSOR FOR GAS FLOW MEASUREMENTS
W. R. Kaminski (University of Central Washington, Ellensburg.), J. W. Griffin, and J. M. Bates Dec. 1991 8 p Presented at the American Society of Mechanical Engineers (ASME) Annual Winter Meeting, Atlanta, GA, 1-6 Dec. 1991
(Contracts DE-AC06-76RL-01830; DE-FG06-89ER-75522)
(DE92-007182; PNL-SA-19773; CONF-911213-22) Avail: NTIS HC/MF A02

This paper presents the results of an investigation to determine the feasibility of a novel approach to measuring gas flow in a pipe. An optical fiber is stretched across a pipe and serves as a sensor which is based upon the well-established principle of vortex shedding of a cylinder in cross-flow. The resulting time varying optical signal produces a frequency component proportional to the average velocity in the pipe which is in turn proportional to volumetric flow. A Mach-Zehnder interferometer is used to enhance the accuracy of the vortex shedding frequency signal. The analytical and experimental effort discussed herein shows that the concept is feasible and holds promise for a sensitive and accurate flow measuring technique. DOE

N92-21247*# Eloret Corp., Sunnyvale, CA.
ADVANCED BALLISTIC RANGE TECHNOLOGY Research Report, 1 May 1991 - 31 January 1992
Leslie A. Yates 6 Mar. 1992 14 p
(Contract NCC2-583)
(NASA-CR-190067; NAS 1.26:190067) Avail: NTIS HC/MF A03 CSCL 14B

Experimental interferograms, schlieren, and shadow-graphs are routinely used for validating ideal- and real-gas computational fluid dynamics (CFD) codes. Interferograms are used for quantitative comparisons of integrated density. Schlieren and shadowgraphs are used for comparing the locations of flow field features; the types of flowfield features recorded in these images include shocks, shear layers, and expansion fans. By constructing images from flow field simulations, one-to-one comparisons of computation and experiment are possible. During the period from 1 May 1991 to 31 Jan. 1992, the emphasis of this research was on developing techniques for constructing these images from flow field simulations. Author

N92-21249# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
SIEVE-SLIT CALIBRATION REPORT OF THE QDD AND THE QDQ SPECTROMETER
Benno vandenBrink 7 Oct. 1991 16 p
(EMIN-91-06; ETN-92-91041) Avail: NTIS HC/MF A03

The matrix elements of the QDQ and the QDD spectrometers were determined. The following are discussed: the reconstruction formalism and the changes made in the case of QDQ; influence of a beam which is not properly centered on a flat (thin) target, and the use of an extended (thick) target; and measurements needed to calibrate the QDD and the QDQ. For the QDQ, the

formalism in the case of an extended target was changed. This results in a better resolution for Theta and Phi. ESA

N92-21350# Naval Ocean Systems Center, San Diego, CA.
LOCAL AREA NETWORK DISTRIBUTED REALTIME CLOCK SYNCHRONIZATION Final Report
D. R. Wilcox Nov. 1991 86 p
(AD-A245177; NOSC-TR-1466) Avail: NTIS HC/MF A05
CSCL 25/5

This report applies the strobe realtime clock synchronization technique to serial busses and local area networks in general, and to the IEEE 802.5 and the Fiber Distributed Data Interface token ring local area network standards in particular. Section 2 examines miscellaneous material relating to adjustable-rate realtime clocks. Section 3 presents adjustable rate realtime clock hardware implementation methods considered superior to those in an earlier report. Section 4 presents a hardware implementation of an IEEE 802.5 strobe detector. GRA

N92-21427 Colorado Univ., Boulder.
A TWIN PATH, SOLID STATE LASER GYROSCOPE Ph.D. Thesis
Jeffrey Ian Webb 1991 225 p
Avail: Univ. Microfilms Order No. DA9206637

A twin path ring laser gyroscope detects rotation as a Sagnac beat frequency shifts between two free-running solid state lasers. The Nd:YAG, monolithic, unidirectional ring lasers operate in a temperature stabilized environment to minimize environmental influences on the beat frequency. The rotation sensitivity is limited by technical noise sources. Diagnostic calculations are presented in which the beat frequency sensitivity to a variety of technical noise sources is determined. A new method for determining the absorption losses of high reflectivity mirrors is presented. Absorption of an input laser beam in the coating layer increases the temperature of the mirror substrate. The resulting deformation of the substrate surface is used as a diagnostic of the absorption characteristics of the coating. We calculate the deformations in both the inelastic and elastic limits. Mode coupling and frequency shifting in a resonator due to the deformation is also presented.
Dissert. Abstr.

N92-21446# Technische Univ., Delft (Netherlands). Afd. Fotogrammetrie.
SUPERIMPOSITION: DESCRIPTION, PRECISION, APPLICATIONS Thesis [SUPERIMPOSITIVE: BESCHRIJVING, PRECISIE, TOEPASSINGEN]
M. vanPersie 8 Feb. 1991 140 p In DUTCH; ENGLISH summary
(ETN-92-90893) Avail: NTIS HC/MF A07

Superimposition was developed as an instrumental extension and a further perfection of the photogrammetric stereoplotter. Superimposition implies the injection of a digital line map in the oculairs of a stereoplotter such that photo and data file of a given area can be seen simultaneously, providing a link between stereoplotter and geographic information system. A literature study of four existing superimposition systems (Intergraph, Kern, Wild and Zeiss) was carried out. Tests show that superimposition systems have a precision of 40 microns in the photo and a line thickness of 30 to 70 microns. The value of superimposition lies in the support of the process and in the detection of changes by revision activities. For the evaluation of the precision of data files or measurements, the injection is too inaccurate as compared to the precision of the stereoplotter. ESA

N92-21581# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VARIOUS OPTIONS FOR ELECTRONIC REBALANCING LOOPS OF STRAPDOWN FLOATED GYROSCOPES [AS DIFERENTES OPCOES PARA A MALHA DE REBALANCEAMENTO ELETRONICO DE UM GIROSCOPIO TIPO FLOATED USADO EM UMA PLATAFORMA STRAPDOWN]
Jose Francisco Ribeiro Jul. 1991 29 p In PORTUGUESE; ENGLISH summary
(INPE-5264-RPQ/653) Avail: NTIS HC/MF A03

A general view is presented of the different concepts for the problem of electronic rebalancing loops of strapdown floated gyroscopes. The loops of rebalancing analyzed are analogue, binary, ternary, and time modulated types. In particular, the errors are discussed along with the interfaces and the electronic implementation of each one of the loops. The rebalancing control loops are compared and one of them is selected for future analysis and simulation. Author

N92-21586* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
WATER COOLED STATIC PRESSURE PROBE Patent
Nicholas T. Lagen, inventor (to NASA), John W. Eves, inventor (to NASA), Garland D. Reece, inventor (to NASA), and Steve L. Geissinger, inventor (to NASA) 31 Dec. 1991 9 p Filed 31 Aug. 1990 Supersedes N91-13684 (29 - 5, p 663)
(NASA-Case-LAR-14340-1-CU; US-Patent-5,076,103; US-Patent-Appl-SN-575695; US-Patent-Class-73-708; US-Patent-Class-73-147; US-Patent-Class-73-182; Int-Patent-Class-G01L-19/04) Avail: US Patent and Trademark Office CSCL 14B

An improved static pressure probe containing a water cooling mechanism is disclosed. This probe has a hollow interior containing a central coolant tube and multiple individual pressure measurement tubes connected to holes placed on the exterior. Coolant from the central tube symmetrically immerses the interior of the probe, allowing it to sustain high temperature (in the region of 2500 F) supersonic jet flow indefinitely, while still recording accurate pressure data. The coolant exits the probe body by way of a reservoir attached to the aft of the probe. The pressure measurement tubes are joined to a single, larger manifold in the reservoir. This manifold is attached to a pressure transducer that records the average static pressure.
Official Gazette of the U.S. Patent and Trademark Office

N92-21710* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THERMAL REMOTE ANEMOMETER SYSTEM Patent
Joseph S. Heyman, inventor (to NASA), Christopher S. Welch, inventor (to NASA), William E. Miller, inventor (to NASA), D. Michele Heath, inventor (to NASA), and William P. Winfree, inventor (to NASA) 4 Feb. 1992 6 p Filed 22 Jan. 1988 Supersedes N88-23962 (26 - 17, p 2342)
(NASA-Case-LAR-13508-1; US-Patent-5,085,073; US-Patent-Appl-SN-146939; US-Patent-Class-73-147; US-Patent-Class-374-124; US-Patent-Class-374-135; US-Patent-Class-73-204.11; Int-Patent-Class-G01F-9/00) Avail: US Patent and Trademark Office CSCL 14B

A sample in a wind tunnel is radiated from a thermal energy source located outside the wind tunnel. A thermal imager system, also located outside the wind tunnel, reads surface radiations from the sample as a function of time. The thermal images produced are characteristic of the heat transferred from the sample to the flow across the sample. In turn, the measured rates of heat loss of the sample are characteristic of the flow and the sample.
Official Gazette of the U.S. Patent and Trademark Office

N92-21723* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ADJUSTABLE DEPTH GAGE Patent
Roger C. Forsgren, inventor (to NASA) 17 Mar. 1992 6 p Filed 7 Jul. 1989 Supersedes N90-10415 (28 - 1, p 72)
(NASA-Case-LEW-14880-1; US-Patent-5,096,340; US-Patent-Appl-SN-376738; US-Patent-Class-408-14; US-Patent-Class-408-16; US-Patent-Class-408-241S; Int-Patent-Class-B23B-39/00) Avail: US Patent and Trademark Office CSCL 14B

A quick adjust depth gage includes a handle-clamp assembly wherein the clamp includes an opening in which a cylindrical shaft with suitable depth measurement markings thereon is reviewed.

Turning the handle on the clamp enables the gage to be set to the desired depth.
Official Gazette of the U.S. Patent and Trademark Office

N92-21822# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
KINEMATIC CALIBRATION OF AN ACTIVE CAMERA SYSTEM
G. S. Young, T. H. Hong, M. Herman, and J. C. S. Yang Nov. 1991 37 p Prepared in cooperation with Maryland Univ., College Park; and American Univ., Washington, DC
(PB92-133008; NISTIR-4715) Avail: NTIS HC/MF A03 CSCL 14E

Here, the authors introduce a modified Denavit-Hartenburg kinematic model and develop a new technique to calibrate an active camera system. The manipulator, camera-to-manipulator, camera, and base-to-world calibrations are all included. The method employs four ideas: 1) the camera poses, joint poses, and link frames calibrated are all related to the world frame, therefore, the camera-to-manipulator and base-to-world calibration is very straightforward; 2) the joint poses are calibrated separately; 3) the manipulator motion is obtained from the camera poses; and 4) once the joint poses are obtained, the link frames can be defined for any kinematic model. In consequence, the whole procedure is simple, flexible, accurate, and efficient. Two experiments were performed to verify the accuracy of the new technique. Author

N92-22031*# Miranda Labs., Bedford, MA.
SPACECRAFT PARTICULATE SIZING SPECTROMETER Final Report
Henry A. Miranda, Jr. 7 Apr. 1992 26 p
(Contract NAS5-30306)
(NASA-CR-190168; NAS 1.26:190168) Avail: NTIS HC/MF A03 CSCL 14B

An evaluation prototype device is described, together with conclusions and several recommendations for follow-on flight hardware. The device detects individual particles crossing an external sensing zone, and produces a histogram displaying the size distribution of particles sensed, over the nominal range of 5 to 50 microns. The output is totally independent of the particle refractive index, and is also largely unaffected by particle shape. The reported diameters are in terms of the equivalent sphere, as judged by the scattered light intercepted by the receiving channels, which develop signals whenever a particle crosses the beam of illumination in the sensing zone. Supporting evidence for the latter assertion is discussed on the basis of experimental test data for non-spherical particulates. Also included is a technical appendix which presents theoretical arguments that provide a firm foundation for this assertion. Author

N92-22038* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
METHOD OF PRODUCING A PLUG-TYPE HEAT FLUX GAUGE Patent
Curt H. Liebert, inventor (to NASA) and John Koch, Jr., inventor (to NASA) 4 Feb. 1992 6 p Filed 8 Apr. 1991 Supersedes N91-23460 (29 - 15, p 2430) Division of US-Patent-Appl-SN-531433, filed 31 May 1990
(NASA-Case-LEW-14967-2; US-Patent-5,086,204;
US-Patent-Appl-SN-685062; US-Patent-Appl-SN-531433;
US-Patent-Class-219-69.17; US-Patent-Class-374-29;
US-Patent-Class-40-703; Int-Patent-Class-B23H-9/00) Avail: US Patent and Trademark Office CSCL 14B

A method of making a plug-type heat flux gauge in a material specimen in which a thermoplug is integrally formed in the specimen is disclosed. The thermoplug and concentric annulus are formed in the material specimen by electrical discharge machining and trepanning procedures. The thermoplug is surrounded by a concentric annulus through which thermocouple wires are routed. The end of each thermocouple wire is welded to the thermoplug, with each thermocouple wire welded at a different location along the length of the thermoplug.
Official Gazette of the U.S. Patent and Trademark Office

N92-22039* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
TWO DIMENSIONAL VERNIER Patent
Richard D. Juday, inventor (to NASA) 28 Jan. 1992 8 p Filed 14 Jan. 1991 Supersedes N91-23462 (29 - 15, p 2430)
(NASA-Case-MSC-21700-1; US-Patent-5,083,378;
US-Patent-Appl-SN-640775; US-Patent-Class-33-10;
US-Patent-Class-33-15D; US-Patent-Class-33-520;
US-Patent-Class-33-644; Int-Patent-Class-G01B-5/02) Avail: US Patent and Trademark Office CSCL 14B

A two-dimensional vernier scale is disclosed utilizing a cartesian grid on one plate member with a polar grid on an overlying transparent plate member. The polar grid has multiple concentric circles at a fractional spacing of the spacing of the cartesian grid lines. By locating the center of the polar grid on a location on the cartesian grid, interpolation can be made of both the X and Y fractional relationship to the cartesian grid by noting which circles coincide with a cartesian grid line for the X and Y direction.
Official Gazette of the U.S. Patent and Trademark Office

N92-21273*# Texas A&M Univ., Galveston. Dept. of Marine Science.
PHOTOGRAPHIC IMAGE RESTORATION Final Report
Gerald E. Hite *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 14B

N92-21673*# Fudan Univ., Shanghai (China).
A YBCO RF-SQUID VARIABLE TEMPERATURE SUSCEPTOMETER AND ITS APPLICATIONS
Luwei Zhou, Jinwu Qiu, Xianfeng Zhang, Zhimin Tang, Yimin Cai, and Yongjia Qian *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 464-468 Sponsored in part by China National Center for Research and Development on Superconductivity, and K.C. Wong Education Foundation, Hong Kong (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics*.

N92-21075# Brookhaven National Lab., Upton, NY.
FAST EXCITATION VARIABLE PERIOD WIGGLER
A. vanSteenbergen, J. Gallardo, T. Romano, and M. Woodle 1991 4 p Presented at the 1991 Institute of Electrical and Electronics Engineers (IEEE) Particle Accelerator Conference (PAC), San Francisco, CA, 6-11 May 1991
(Contract DE-AC02-76CH-00016)
(DE92-007573; BNL-45564; CONF-910505-437) Avail: NTIS HC/MF A01

The design of an easily stackable, variable period length, fast excitation driven wiggler, making use of geometrically alternating substacks of Vanadium Permandur ferromagnetic laminations, interspaced with conductive, non magnetic, laminations which act as eddy current induced 'field reflectors', is discussed and experimental results obtained with short wiggler models are presented. DOE

N92-21108# Texas Univ., Austin. Dept. of Physics.
KINETIC STUDIES FOLLOWING STATE-SELECTIVE LASER EXCITATION
J. W. Keto Jan. 1992 9 p
(Contract DE-FG05-84ER-13191)
(DE92-007705; DOE/ER-13191/12) Avail: NTIS HC/MF A02

We have made measurements of state-to-state deactivation cross sections and radiative lifetimes for Xe*(6p,6p',7p) and Kr*(5p) states in xenon and krypton buffer gases. These results are relevant

to kinetic models and both excimer lasers and the infrared xenon laser; and they are a significant improvement in the precision of the known radiative lifetimes. This type of experiment can now be compared with recent calculations of state-to-state collisional relaxation in rare-gases by Hickman, Huestis, and Saxon. We have also made significant progress in the study of the electronic spectra of small molecules of the rare gases. Spectra have been obtained for Xe2, Xe3, Xe4, and larger clusters. As guidance for the larger clusters of the rare gases, we have obtained the first multiphoton spectra for excitons in condensed xenon. In collaboration with research on the multiphoton spectra of the rare gases, we have continued experiments using synchrotron radiation in collaboration with the University of Hamburg. In experiments there we have observed excitation and fluorescence spectra for single xenon atoms at the surface, within the second layer, and within the bulk of large argon clusters. DOE

N92-21124# Brookhaven National Lab., Upton, NY.
LASER-SYNCHROTRON HYBRID EXPERIMENTS: A PHOTON TO TICKLE, A PHOTON TO POKE
D. L. Ederer, J. E. Rubensson, D. R. Mueller, R. Shuker, W. L. OBrien, J. Jai, Q. Y. Dong, T. A. Callcott, G. L. Carr (Grumman Aerospace Corp., Bethpage, NY.), and G. P. Williams et al 1991 21 p Presented at the 7th National Conference and Exhibition, Baton Rouge, LA, 28-31 Oct. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007611; BNL-45043; CONF-9110146-11) Avail: NTIS HC/MF A03

In this paper we present the preliminary results from a new experimental technique to synchronize the pulses from a mode-locked NdYAG laser to the light pulses in the VUV storage ring at the National Synchrotron Light Source (NSLS). We describe a method to electronically change the delay time between the laser pulses and the synchrotron pulses. We also illustrate a method to overlap the synchrotron pulses with the laser pulses in space and time. Preliminary results will be presented for two experiments. DOE

N92-21126# Lawrence Livermore National Lab., CA.
PROCESSES FOR THE ELIMINATION OF FOGGING ON KDP CRYSTALS PRIOR TO AND DURING USE IN LASER SYSTEMS
I. M. Thomas, M. R. Kozlowski, G. Edwards, K. Stanion, and B. Fuchs Jan. 1992 14 p Presented at the SPIE International Society for Optical Engineering Meeting, Boulder, CO, 23-25 Oct. 1991
(Contract W-7405-eng-48)
(DE92-008077; UCRL-JC-108273; CONF-911064-6) Avail: NTIS HC/MF A03

The rate of surface fogging on KDP crystals has been associated with several parameters in the diamond turning and subsequent cleaning process. Fogging can also occur during use because of environmental degradation. We have determined that reaction of the KDP surfaces with additives in the diamond turning oil has been a major factor in fogging and have found a replacement oil that eliminates this effect. We have also developed an antireflective silicone-sol coating that also reduces surface environmental deterioration during use by a factor of four. DOE

N92-21165# Stanford Univ., CA. Dept. of Chemistry.
STANFORD FREE ELECTRON LASER MATERIALS RESEARCH: PICOSECOND NONLINEAR STUDIES OF CONDENSED MATTER SYSTEMS Final Report
Michael D. Fayer 1991 8 p
(Contract N00014-89-K-0154)
(AD-A245197) Avail: NTIS HC/MF A02 CSCL 14/2

The Stanford SCA/FEL is a powerful tool which provides unique capabilities for conducting materials research. The FEL can be used to obtain information of fundamental importance on a wide variety of materials such as high temperature superconductors; semiconductors, including amorphous materials and multi-quantum well structures; inorganic and organic crystals and glasses; biological materials, for example, hemoglobin, proteins, DNA, and membranes; surfaces and molecules on surfaces; polymeric solids and liquids. In all cases it is the unique operating characteristics of the SCA/FEL, providing single, high powered, picosecond pulses tunable across the IR spectrum, which makes it possible to probe matter with methods that have previously been impossible. GRA

N92-21225# Lawrence Livermore National Lab., CA.
MODAL STUDY OF REFRACTIVE EFFECTS ON X RAY LASER COHERENCE
P. Amendt, R. A. London, and M. Strauss Dec. 1991 32 p Presented at the Conference on Short-Wavelength Coherent Radiation, Monterey, CA, 4-10 Apr. 1991
(Contract W-7405-eng-48)
(DE92-007338; UCRL-JC-105736-Rev-1; CONF-9104164-3-Rev-1)
Avail: NTIS HC/MF A03

The role of smoothly varying transverse gain and refraction profiles on x-ray laser coherence is analyzed by modally expanding the laser electric field within the paraxial approximation. Comparison with a square transverse profile reveals that smoothly varying profiles generally lead to a greatly reduced number of guided modes and a consequent improvement in transverse coherence length. However, the refractive defocussing responsible for enhanced coherence can also significantly degrade the coherent power of x-ray lasers based on amplified spontaneous emission. An optimal value to Fresnel number is indicated, below which the coherent power rapidly decreases as refractive defocussing is increased. Further improvement in the coherence length without degradation of coherent power may require multipass architectures with spatial filtering instead of relying on increased refraction through narrowing of the laser. DOE

N92-21323# Sandia National Labs., Albuquerque, NM.
LASER-INDUCED DAMAGE STUDIES ON STEP-INDEX, MULTIMODE FIBERS
R. E. Setchell and P. Klingsporn 1991 9 p Presented at the SPIE International Society for Optical Engineering Meeting, Boulder, CO, 23-25 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-007312; SAND-92-0034C; CONF-911064-4) Avail: NTIS HC/MF A02

A previous investigation of laser-induced damage mechanisms and corresponding thresholds in step-index, multimode fibers was motivated by an interest in optical systems for firing explosives. In the initial study, the output from a compact, multimode Nd/YAG laser was coupled into fiber cores of pure fused silica. End-face polishing steps were varied between successive fiber lots to produce improved finishes, and each fiber was subjected to a sequence of progressively increasing energy densities up to a value more than 80 J/sq cm. Essentially all of the tested fibers experienced a 'laser conditioning' process at the front fiber face, in which a visible plasma was generated for one or more laser shots. However, rather than producing progressive damage at the front surface, this process would eventually cease and leave the surface with improved damage resistance. Once past this conditioning process, the majority of fibers damaged are at the rear end face. Other modes of damage were observed either at locations of fixturing stresses or at a location of high static tensile stress resulting from bends introduced to the fiber. The current experiments were conducted with a new laser having a shorter pulsewidth and a significantly different mode structure. The beam was injected into the fiber using a geometry that had been successful in the previous study in minimizing a damage mechanism which can occur at the core/cladding interface within the first few hundred fiber diameters. However, the different mode structure of the new laser apparently resulted in this mechanism dominating the current results. DOE

N92-21353# Universal Energy Systems, Inc., Dayton, OH.
MONOLITHIC INTEGRATION OF A DFB SUPERLATTICE LASER USING HIGH ENERGY ION IMPLANTATION Final Technical Report, 30 Sep. 1987 - 29 Mar. 1990
P. P. Pronko, A. K. Rai, D. Ingram, A. W. McCormick, and A. Ezis 13 Feb. 1991 85 p

(Contract N00019-87-C-0267)
(AD-A245184) Avail: NTIS HC/MF A05 CSCL 09/1

The objective of this research is to develop the use of high energy (MeV) and medium energy (keV) ion beams for the purpose of selectively modifying the optical properties of superlattice systems consisting of mixed III-V compound semiconductors. In particular, the research was directed at the AlGaAs/GaAs multilayer superlattice system and its potential use in fabricating a monolithically integrated distributed feedback laser for use in optoelectronic circuits. The optical properties of such semiconductor superlattice systems have been shown to be sensitive to ion bombardment and its associated implantation and mixing process. The use of ion beams makes it possible to modify these structures through selective masking so that optical elements such as lasers, waveguides, and switches could be fabricated under the constraints imposed by monolithic integration. In particular, investigations were made into the effects of implantation controlled disordering of AlGaAs and GaAs through impurity, defect, and ion beam mixing effects. The results of this work were applied to the development and fabrication of an ion implanted distributed feedback (DFB) type laser in a multilayer superlattice system. GRA

N92-21399# Brookhaven National Lab., Upton, NY.
PROPOSED ULTRAVIOLET FREE-ELECTRON LASER AT BROOKHAVEN NATIONAL LABORATORY: A SOURCE FOR TIME-RESOLVED BIOCHEMICAL SPECTROSCOPY
E. D. Johnson, J. C. Sutherland, and W. R. Laws 1992 7 p Presented at the Society of Photo-Optical Instrumentation Engineers' International Symposium on Laser Spectroscopy, Los Angeles CA, 20-22 Jan. 1992
(Contract DE-AC02-76CH-00016)
(DE92-007451; BNL-47086; CONF-920124-8) Avail: NTIS HC/MF A02

Brookhaven National Laboratory is designing an ultraviolet free-electron laser (UV-FEL) user facility that will provide pico-second and sub-picosecond pulses of coherent ultraviolet radiation for wavelengths from 300 to 75 nm. Pulse width will be variable from about 7 ps to approximately 200 fs, with repetition rates as high as 10(exp 4) Hz, single pulse energies greater than 1 mJ and hence peak pulse power greater than 200 MW and average beam power greater than 10 W. The facility will be capable of 'pump-probe' experiments utilizing the FEL radiation with: (1) synchronized auxiliary lasers, (2) a second, independently tunable FEL beam; or (3) broad-spectrum, high-intensity x-rays from the adjacent National Synchrotron Light Source. The UV-FEL consists of a high repetition rate recirculating superconducting linear accelerator which feeds pulses of electrons to two magnetic wigglers. Within these two devices, photons from tunable 'conventional' laser would be frequency multiplied and amplified. By synchronously tuning the seed laser and modulating the energy of the electron beam, tuning of as much as 60 percent in wavelength is possible between alternating pulses supplied to different experimental stations, with Fourier transform limited resolution. Thus, up to four independent experiments may operate at one time, each with independent control of the wavelength and pulse duration. The UV-FEL will make possible new avenues of inquiry in time studies of diverse field including chemical, surface, and solid state physics, biology, and materials science. The experimental area is scheduled to include a station dedicated to biological research. The complement of experimental and support facilities required by the biology station will be determined by the interests of the user community. DOE

N92-21400# Lawrence Livermore National Lab., CA.
MEASUREMENTS OF LASER IRRADIANCE IN THE HIGH-POWER SECOND-HARMONIC NOVA FOCUS
P. Wegner 23 Dec. 1991 59 p
(Contract W-7405-eng-48)
(DE92-007507; UCRL-ID-109274) Avail: NTIS HC/MF A04

This report briefly summarizes the analysis of a set of equivalent-plane photographs of the pulsed second-harmonic Nova beam that were obtained with the two beam laser diagnostic system (TBLDS). The photographs span a limited region of focus from 0.6 mm before focus to 1.8 mm after focus. Measurements of a 2.5 TW pulse at 'best focus' indicate an average intensity of 2 x 10(exp 16) W/cm(exp 2) with peaks of approximately 5 x 10(exp 17) W/cm(exp 2). Eighty percent of the laser power is contained inside a radius of 75 microns at which radius the radially-averaged intensity is approximately 5 x 10(exp 15) W/cm(exp 2). Second-harmonic laser energy diffracted into large angles by the frequency-conversion crystal support structure is present at intensities on the order of 5 x 10(exp 13) W/cm(exp 2) at twice the 80 percent radius, and greater than 5 x 10(exp 12) W/cm(exp 2) well outside this radius, where approximately 2 percent of the laser energy resides. The 80 percent-power diameter has been traditionally called the laser 'spot size'. Plots of the spot size versus focus reveal a 1-mm waist region after which the spot size approaches the geometrical limit expected for an f/4.5 beam. These results are similar to previously reported measurements of the Nova third-harmonic focus made with the Opposed Port Diagnostic. The independence of spot size on wavelength indicates that the characteristics of the Nova focus are determined principally by the wavefront of the 1.05-micron pulse, which is transferred to the harmonic pulse (with relatively minor modification due to crystal figure) in the frequency-conversion process. DOE

N92-21596# Oak Ridge National Lab., TN.
LASER SPECTROSCOPY AND LASER ION SOURCE DEVELOPMENT AT UNISOR
Carrol Bingham (Tennessee Univ., Knoxville.) 1991 15 p Presented at the International Symposium on Reflections and Directions in Low Energy Heavy Ion Physics, Oak Ridge, TN, 14-15 Oct. 1991
(Contracts DE-FG05-87ER-40361; DE-AC05-76OR-00033)
(DE92-007835; CONF-9110289-3) Avail: NTIS HC/MF A03

The development of the laser spectroscopy facility at UNISOR will be described. The method of collinear laser-atomic beams interaction is utilized to achieve atomic spectra essentially free of Doppler spreading. Measurement of resonance fluorescence via an efficient fiber-optic light collector is used to observe the atomic excitation by the laser beam. The system has been utilized to measure the atomic lifetime of the 6p(sup 4)Ps/2(sup 0) level in Xe II. In other experiments the relativistic Doppler effect was measured as a test of time dilation. Hyperfine structure and isotope shift measurements have been made for a series of Tl atoms ranging in mass from 187 to 205. Magnetic dipole and electric quadrupole moments were deduced for several of these isotopes; these quantities and the isotope shifts added greatly to our understanding of nuclear shapes in this transition region. Future directions will focus around more sensitive detection techniques and the development of purer beams in order to enable the study of nuclei farther from stability. The development of a laser ion source which operates in a completely cold mode and utilizes resonant absorption in the ionization process world facilitate the production of ultra-pure atomic beams. DOE

N92-21700# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Zentralbereich Technik.
DIODE-LASER MINIATURE SOLID STATE LASERS
Nikolaus P. Schmitt, Stefan Heinemann, Axel Mehnert, and Peter Peuser 18 Jun. 1991 6 p Presented at Laser 1991, Munich, Fed. Republic of Germany, 10-14 Jun. 1991
(MBB-Z-0366-91-PUB; ETN-92-90992) Avail: NTIS HC/MF A02

Optical pumping of laser crystals with new diode lasers provides an interesting potential for miniaturizating solid state lasers. This leads to small laser systems where a laser diode, transfer optics and a laser crystal are integrated into a hybrid chassis. These lasers exhibit a high beam quality and stability. Experimental setups and laboratory results are described. By means of miniaturizing, new interesting laser properties were found to result. ESA

N92-21701# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Zentralbereich Technik.
NEW SOLID STATE LASER FOR APPLICATIONS IN LIDAR SYSTEMS

Axel Mehnert, Peter Peuser, and Nikolaus P. Schmitt 18 Jun. 1991 5 p Presented at Laser 1991, Munich, Fed. Republic of Germany, 10-14 Jun. 1991
(MBB-Z-0385-91-PUB; ETN-92-90993) Avail: NTIS HC/MF A01

A compact, pulsed diode array pumped Nd:YAG laser which can be used as a transmitter laser in remote sensing systems is described. The laser is side pumped with quasi continuous wave linear diode arrays close coupled to a zigzag slap laser crystal. When pumped at 24 mJ a pulse energy of 11 mJ was achieved for free running operation, corresponding to a slope efficiency of n(slope) = 47 percent. Results of q switched operation and intracavity second harmonic generation are presented. The laser can be used as a basis device to generate radiation at many other wavelengths. ESA

N92-21737# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Zentralbereich Technik.
DIODE-PUMPED, ACTIVELY STABILIZED 1W SINGLE-FREQUENCY-LASER FOR OPTICAL MEASUREMENT AND TESTING
Juergen M. Plorin, Axel Mehnert, Peter Peuser, and Nikolaus P. Schmitt 18 Jun. 1991 6 p Presented at Laser 1991, Munich, Fed. Republic of Germany, 10-14 Jun. 1991
(MBB-Z-0364-91-PUB; ETN-92-90990) Avail: NTIS HC/MF A02

The principle of a diode pumped solid state laser is especially suited for the construction of single frequency lasers and actively controlled lasers because of the favorable thermal conditions. A single frequency laser according to the twisted mode cavity principle is described. Output powers of 340 mW and 1050 mW were achieved by using laser diodes with 1 W and 3 W of pump power, respectively. By means of an active frequency control device fine tuning of the laser frequency could be realized as well as considerable reduction in the laser linewidth. ESA

N92-21738# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Zentralbereich Technik.
DIODE-PUMPED MICROCRYSTAL-LASERS FOR OPTICAL MEASUREMENT AND TESTING
Stefan Heinemann, Axel Mehnert, Peter Peuser, and Nikolaus P. Schmitt 18 Jun. 1991 6 p Presented at Laser 1991, Munich, Fed. Republic of Germany, 10-14 Jun. 1991
(MBB-Z-0365-91-PUB; ETN-92-90991) Avail: NTIS HC/MF A02

Miniaturized diode laser pumped monolithic solid state lasers of Nd:YAG, Nd:GGG and LNP were investigated. These small lasers can efficiently emit single frequency radiation at 1.06 and 1.3 micrometers. It was found that the lasers can operate simultaneously at three electronic transitions between the Stark splitted laser levels. By using the polarizations of the laser diode and of the microcrystal laser, stable operation at one, two or three transitions was achieved. Thermal problems limiting the obtainable single longitudinal mode output power are discussed. Frequency doubling was realized with a Nd:GGG microcrystal. ESA

N92-21754# Northeast Semiconductor, Inc., Ithaca, NY.
INNOVATIVE TECHNIQUES FOR THE PRODUCTION OF LOW COST 2D LASER DIODE ARRAYS Monthly Technical Report No. 1, Oct. - Nov. 1991
Michael J. Cook 26 Nov. 1991 7 p
(Contract N00014-91-C-0222)
(AD-A244807) Avail: NTIS HC/MF A02 CSCL 09/3

The development of a low cost, high yield methodology for processing, packaging, and characterization of MBE grown two dimensional high power laser diode arrays is discussed. Projected increases in overall yield of Aluminum Gallium Arsenide diode lasers would reduce manufacturing cost from the current $10 to $20 per peak watt to below $3 per peak watt. Emphasis is placed on innovative packaging techniques that will utilize recent advances in diamond heat sinking technology. GRA

N92-21800# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
STATISTICS OF A REFLECTED BEAM IN STRONG TURBULENCE
J. H. Churnside Oct. 1991 29 p
(PB92-129956; NOAA-TM-ERL-WPL-214) Avail: NTIS HC/MF A03 CSCL 20E

Researchers measured the mean and variance of the irradiance of a diverging laser beam after reflection from a retroreflector and a plane mirror in the turbulence atmosphere. An increase in both mean irradiance and normalized variance were observed in the direct backscatter direction because of the correlation of the turbulence on the outgoing path and the return path. The backscattered irradiance was enhanced by about a factor of two, and the variance somewhat less. Author

N92-22068*# Australian National Univ., Canberra. Dept. of Physics and Theoretical physics.
SQUEEZED LIGHT FROM CONVENTIONALLY PUMPED MULTI-LEVEL LASERS
T. C. Ralph and C. M. Savage *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 225-227 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20E

N92-22072*# Georgia Inst. of Tech., Atlanta. School of Physics.
AMPLITUDE SQUEEZED LIGHT FROM A LASER
D. L. Hart and T. A. B. Kennedy *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 241-243 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N92-21087# Universiteit Twente, Enschede (Netherlands).
MULTILEVEL SOLUTION OF THE EHL LINE AND POINT CONTACT PROBLEMS Ph.D. Thesis
Cornelis Henricus Venner 1991 332 p Sponsored by SKF Engineering and Research Center
(ISBN-90-9003974-0; ETN-92-90891) Copyright Avail: NTIS HC/MF A15

The development of faster and more stable solvers for both the Elasto Hydrodynamic Lubrication (EHL) line and point contact problems, occurring for example in roller bearings and between gear wheels, is addressed. A mathematical model describing the lubrication of EHL contacts is described and numerical multigrid (or multilevel) techniques enabling the fast solution of the model equations are outlined. The stability problems are analyzed and solved, resulting in solvers enabling the solution of the EHL line and point control problem using large numbers of grid points on a small capacity computer. The 'standard' EHL problems, which assume perfectly smooth surfaces, are solved for a wide range of load conditions, including extremely high loads. The developed algorithms are shown to meet the demands by applying them to more complex (realistic) EHL line and point contact situations. In particular, the effects of several surface features upon pressure profile and film thickness for practical (high) loading conditions are investigated for both line and point contact situations. Transient effects are discussed. The study of surface features led to some interesting new insights both in general as well as with respect to the surface life of EHL contacts. Recommendations for future research are given. ESA

N92-21104# Sandia National Labs., Livermore, CA.
FEEDBACK CONTROL OF ARC WELDING USING QUANTITATIVE FEEDBACK THEORY

A. E. Bentley Feb. 1991 38 p
(Contract DE-AC04-76DP-00789)
(DE92-004678; SAND-91-8201) Avail: NTIS HC/MF A03

A feedback system has been developed for quality control in arc welding. This new system uses a high temperature fiber-optic cable to measure and control the amount of infrared light emitted from the back side of the weld. The cable is only 1/16 of an inch in diameter, so it can be inserted into any vessel which has a small opening at either end. The system also measures the travel speed of the part to make weld quality independent of part thickness and travel speed. Constant penetration has been demonstrated in tests with travel speeds ranging from 0 to 6 inches per minute, and with 200 percent changes in part thickness. The system also compensates for sharp discontinuities in heat sinking and arc length. DOE

N92-21119 Florida Atlantic Univ., Boca Raton.
HYBRID TELEMANIPULATION SIMULATION FOR MISSION REHEARSAL AND INTERVENTION Ph.D. Thesis
Emmanuel Ikechukwu Agba 1991 119 p
Avail: Univ. Microfilms Order No. DA9203225

A 'hybrid' telerobotic simulation system that is suitable for telemanipulation rehearsal, operator training, human factors study and operator performance evaluation has been developed. The simulator also has the capabilities for eventual upgrade for supervisory control. It is capable of operation in the conventional rate-control, master/slave control and a data driven preprogrammed mode of operation. It has teach/playback capability which allows an operator to generate joint commands for real time teleoperation. For high-level task execution, the operator selects a specific task from a set of menu options and the simulator automatically generates the required joint commands. The simulator was developed using a three dimensional graphic model of an increasingly popular manipulator, TITAN 7F. A closed-form solution for inverse kinematics of the manipulator was found. Degeneracies from inverse kinematics solutions was observed to exist for certain arm configurations, although the manipulator can physically attain such configurations. An approach based on the known facts about the manipulator geometry and physical constraints coupled with heuristics was used to generate physically attainable joint solutions from the inverse kinematics. The conditions that cause solution degeneracy were demonstrated to be related to singularity conditions. A novel object interaction detection strategy was implemented for more realistic telemanipulation. The object detection technique was developed based on the use of superellipsoid, which has a convenient inside-outside function for interference testing. The manipulator, with its end-effector and payloads, if any, were modelled as superquadric ellipsoids. A systematic way of determining transformation matrices between the superquadric manipulator links was developed. The interaction detection technique treats both moving and stationary objects in a consistent manner and has proven to be easy to implement and optimize for real-time applications. The feature has been applied for the simulation of pick-and-place operations and collision detection. It is also used to provide visual feedback as a low-cost force reflection and can be interfaced with a bilateral controller for force reflection simulation. Author

N92-21218# Sandia National Labs., Albuquerque, NM.
CONNECTIONIST AND NEURAL NET IMPLEMENTATIONS OF A ROBOTIC GRASP GENERATOR
S. A. Stansfield Jan. 1992 15 p Presented at the International Society for Optical Engineering (SPIE) Conference, Orlando, FL, 20 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006832; SAND-91-1746C; CONF-920471-1) Avail: NTIS HC/MF A03

This paper presents two parallel implementations of a knowledge-based robotic grasp generator. The grasp generator, originally developed as a rule-based system, embodies a knowledge of the association between the features of an object and the set of valid hand shapes/arm configurations which may be used to grasp it. Objects are assumed to be unknown, with no a priori models available. The first part of this paper presents a 'parallelization' of this rule base using the connectionist paradigm. Rules are mapped into a set of nodes and connections which represent knowledge about object features, grasps, and the required conditions for a given grasp to be valid for a given set of features. Having shown that the object and knowledge representations lend themselves to this parallel recasting, the second part of the paper presents a back propagation neural net implementation of the system that allows the robot to learn the association between object features and appropriate grasps. DOE

N92-21413 California Univ., Berkeley.
REPETITIVE CONTROL AND ITS APPLICATIONS TO DIRECT DRIVE ROBOT MANIPULATIONS Ph.D. Thesis
George Anwar 1991 139 p
Avail: Univ. Microfilms Order No. DA9203481

This dissertation presents the implementation and theoretical analysis of four methods of repetitive control used to eliminate known and measurable periodic tracking error in direct drive robot manipulators. The first method investigates a discrete time repetitive control approach which is applied through the entire trajectory of a robot during repetitive tasks. Simulation and experimental results show that the repetitive controller in conjunction with a simple proportional derivative (PD) control law assures good tracking performance when the desired trajectory is periodic and its period is known. A second method is a segmented approach to repetitive control. Unlike the previous design which applies repetitive control throughout the entire path of the robot, the segmented approach applies repetitive control to only specific segments of the path. The stability of the segmented repetitive control system is presented. Simulation and experimental results of a two link direct drive SCARA-type robot arm under segmented repetitive control are also presented. The third method investigates Cartesian space repetitive control. In Cartesian space repetitive control the feedback signal is acquired from the end effector of the manipulator, in contrast to conventional joint control which utilizes joint oriented sensors such as shaft encoders, or resolvers. Although conventional joint level repetitive control significantly improves the performance of the robot in the presence of dynamic model mismatches and disturbances, Cartesian space repetitive control is necessary if kinematic modelling error is to be eliminated. An X-Y digitizer is used as an End Effector Cartesian Coordinate Sensor (EECCS). The Cartesian space repetitive controller is shown to be successful in eliminating the repetitive error in both simulation and implementation. An implementation of Plug-In Repetitive Control on the direct drive axis of a prototype GMF A500 robot is also treated in this thesis to illustrate the possible use of repetitive control in an industrial environment. Plug-In Repetitive Control is developed and implemented using an IBM AT. A multirate sampling algorithm is designed to reduce the memory requirements of repetitive control. Experimental results show that the tracking error is smoothly absorbed by the Plug-In repetitive controller in a few cycles. A two axis direct drive SCARA robot utilizing NSK megatorque direct drive motors is used to test the algorithms developed in this dissertation. Author

N92-21441# Engine Research Associates, Inc., Fort Wayne, IN.
A QUIET OPERATING I.C. ENGINE WITH COMPLETE HIGHLY EFFICIENT EXPANSION CYCLE
2 Dec. 1991 15 p
(Contract DE-FG01-88CE-15387)
(DE92-004946; DOE/CE-15387/T13) Avail: NTIS HC/MF A03

A program for the development of a quiet internal combustion engine with a complete highly efficient expansion cycle was administered by the Department of Energy from 14 Jun. 1988 - 13 Dec. 1989. An extension, modification M001 to the contract allowed up to 12 Jun. 1991 to complete this work. The extension was granted in order for Engine Research Associates, Inc. (ERA) to continue the development of the engine with its own funds to a level of performance required for an independent testing facility to test and report on the engine's performance. We were not able to complete all of the detailed development work necessary

to bring the engine up to a status that would allow an independent test lab to complete the full-up performance testing on the engine. However, we were able to incorporate enough refinements to complete a restricted dynamometer test program. A discussion of these refinements and how we were able to conduct a restricted test is discussed under program accomplishments. DOE

N92-21500* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
J-HOOK LATCHING DEVICE Patent
Malcolm B. Milam, inventor (to NASA) 11 Feb. 1992 13 p Filed 13 Feb. 1991
(NASA-Case-GSC-13200-1; US-Patent-5,087,088;
US-Patent-Appl-SN-654454; US-Patent-Class-292-110;
US-Patent-Class-292-DIG.39; Int-Patent-Class-E05C-5/02) Avail: US Patent and Trademark Office CSCL 13K

Described here is a latching device for latching two items together that has a housing and a shaft mounted to one item such that rotation of the shaft by a sprocket causes the shaft to move longitudinally up and down. The shaft has one end extending beyond the housing with an alignment cone attached to this end for engaging a receptor on the other item. A latch mounted to a shaft by a traveling nut provides a pivot point for the latch so that rotation of the shaft causes the pivot point of the latch to translate along the longitudinal axis of the shaft. Camming surfaces and a camming spring are used for rotating the latch so that the latch will engage and disengage a receptor on the other item.
Official Gazette of the U.S. Patent and Trademark Office

N92-21726* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
METALLIC THREADED COMPOSITE FASTENER Patent
Thomas J. Dunn, inventor (to NASA) 25 Feb. 1992 7 p Filed 31 Jan. 1991 Supersedes N91-23491 (29 - 15, p 2435)
(NASA-Case-MSC-21580-1; US-Patent-5,090,857;
US-Patent-Appl-SN-648772; US-Patent-Class-411-385;
US-Patent-Class-411-65; US-Patent-Class-411-354;
US-Patent-Class-411-901; US-Patent-Class-411-908;
Int-Patent-Class-F16B-19/00; Int-Patent-Class-F16B-35/02)
Avail: US Patent and Trademark Office CSCL 13K

A metallic threaded composite fastener, particularly suited for high temperature applications, has a body member made of high temperature resistant composite material with a ceramic coating. The body member has a head portion configured to be installed in a countersunk hole and a shank portion which is noncircular and tapered. One part of the shank may be noncircular and the other part tapered, or the two types of surface could be combined into a frustum of a noncircular cone. A split collar member made of high strength, high temperature tolerant metal alloy is split into two halves and the interior of the halves are configured to engage the shank. The exterior of the collar has a circumferential groove which receives a lock ring to secure the collar halves to the shank. In the assembled condition torque may be transmitted from the body to the split collar by the engaged noncircular portions to install and remove the fastener assembly into or from a threaded aperture and shear loads in the collar threads are transferred to the shank tapered portion as a combination of radial compression and axial tension loads. Thus, tension loads may be applied to the fastener shank without damaging the ceramic coating.
Official Gazette of the U.S. Patent and Trademark Office

N92-21727* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
PRESSURE VESSEL FLEX JOINT Patent
Jon B. Kahn, inventor (to NASA) 7 Apr. 1992 13 p Filed 19 Feb. 1991 Supersedes N91-25415 (29 - 17, p 2785)
(NASA-Case-MSC-21748-1; US-Patent-5,102,150;
US-Patent-Appl-SN-657598; US-Patent-Class-277-3;
US-Patent-Class-277-34; US-Patent-Class-277-34.3;
US-Patent-Class-285-97; US-Patent-Class-285-223;
US-Patent-Class-285-346; US-Patent-Class-285-910) Avail: US Patent and Trademark Office CSCL 13I

An airtight, flexible joint is disclosed for the interfacing of two pressure vessels such as between the Space Station docking tunnel and the Space Shuttle Orbiter bulkhead adapter. The joint provides for flexibility while still retaining a structural link between the two vessels required due to the loading created by the internal/external pressure differential. The joint design provides for limiting the axial load carried across the joint to a specific value, a function returned in the Orbiter/Station tunnel interface. The flex joint comprises a floating structural segment which is permanently attached to one of the pressure vessels through the use of an inflatable seal. The geometric configuration of the joint causes the tension between the vessels created by the internal gas pressure to compress the inflatable seal. The inflation pressure of the seal is kept at a value above the internal/external pressure differential of the vessels in order to maintain a controlled distance between the floating segment and pressure vessel. The inflatable seal consists of either a hollow torus-shaped flexible bladder or two rolling convoluted diaphragm seals which may be reinforced by a system of straps or fabric anchored to the hard structures. The joint acts as a flexible link to allow both angular motion and lateral displacement while it still contains the internal pressure and holds the axial tension between the vessels.
Official Gazette of the U.S. Patent and Trademark Office

N92-21728* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ROLLER LOCKING BRAKE Patent
John M. Vranish, inventor (to NASA) 14 Apr. 1992 8 p Filed 28 Mar. 1991 Supersedes N91-28579 (29 - 20, p 3354)
(NASA-Case-GSC-13376-1; US-Patent-5,103,941;
US-Patent-Appl-SN-677008; US-Patent-Class-188-171;
US-Patent-Class-188-82.84; US-Patent-Class-188-82.9;
Int-Patent-Class-B60T-13/04) Avail: US Patent and Trademark Office CSCL 13I

A roller locking brake structure is described. The structure includes a roller locking/lifting ring, a housing, a set of conical locking rollers, a striker ring, and a drive disc. The roller locking/lifting ring includes respective V-shaped locking cam surface segments for each locking roller which is in the form of a truncated cone and provides a force and torque reaction surface for forces and torques generated in the braking process as well as providing a channel for a magnetic coil and flux return path of a magnetic circuit used to release a conical roller when the brake is off. The locking conical rollers couple the ring to the rim surfaces of the drive disc which provides another cam surface. The striker ring is located next to the rollers and is pulled down against the small end of the rollers by an electromagnetic coil when energized to decouple the locking rollers from the drive disc and thus cease the braking action.
Official Gazette of the U.S. Patent and Trademark Office

N92-21790# Quest Integrated, Inc., Kent, WA.
CONTROLLED DEPTH MACHINING WITH ABRASIVE-WATER-JETS, PHASE 2
M. Hashish, A. Ansari, R. C. Lilley, and R. F. Johnson Jun. 1991 149 p
(Grant NSF ISI-85-21279)
(PB92-122894; QUEST-TR-527; NSF/ISI-91004) Avail: NTIS HC/MF A07 CSCL 13H

The process of milling with abrasive waterjets (AWJs) was experimentally and analytically investigated. In the milling process, the depth of penetration has to be accurately controlled. A number of concepts were evaluated to mill pockets and remove surface areas from hard to machine materials. It was found that applying the jet at impact and rake angles is significantly better than applying it at normal angles. The approach is very beneficial for surface removal applications. A rotary AWJ tool was built and used to mill slots in glass. The method used high volume removal rates but does not allow much control over the depth of the cavity. The dynamic real-time manipulation of jet parameters to control jet structure and effectiveness proved to be inadequate due to the fast response time required from control devices. The use of high transverse rates and a mask was found to be the most practical approach. Author

N92-21978*# Draper (Charles Stark) Lab., Inc., Cambridge, MA.
ANALYSIS OF ITT SCAN BEARING PACKAGE (BEARING PACKAGE S/N 7-1004)
Erik Gelotte and John Kauppinen Dec. 1991 45 p
(Contract NAS9-18147)
(NASA-CR-189540; NAS 1.26:189540; CSDL-C-6257) Avail: NTIS HC/MF A03 CSCL 13I

A geostationary operational environments satellite (GOES) East-West scan-bearing assembly was examined after having completed two and one-half years of operation. The following results were found: (1) lubrication breakdown was found in both bearings; (2) patchy wear-bands running only approximately half-way around the races indicated a load distribution in the ball groups consistent with a very low preload; (3) contact angles of 31.2 deg (S/N 1004) and 28.7 deg (S/N 1004A) were found in bearings whose contact angles are supposed to be 20+/-2 deg; and (4) contamination was present in the bearings. Author

N92-21989# Technische Univ., Berlin (Germany, F.R.). Fachbereich Verkehrswesen.
THE ROLLING CONTACT OF TWO VISCOELASTIC ROLLERS WITH COULOMB FRICTION Ph.D. Thesis [ROLLKONTAKT ZWEIER VISKOELASTISCHER WALZEN MIT COULOMBSCHER REIBUNG]
Guangqiu Wang 1991 170 p In GERMAN
(ETN-92-91157) Avail: NTIS HC/MF A08

It is shown that the complete solution of the two dimensional stationary and unsteady contact problem is realized, under the assumption of a viscoelastic standard body with constant lateral deformation number. An integral equation process, the boundary element method, is used to solve this rolling contact problem. It requires low commutation costs, as compared with finite element method. The stationary contact problem is solved, and the normal and tangential contact problem is dealt with separately. It is solved by an iteration process. The influence of inertia forces on the stationary rolling process is examined. For the unsteady contact problems, the examination is limited to the unsteady rolling process, at periodically variable slipping. ESA

N92-21993# Technische Univ., Berlin (Germany, F.R.). Fachbereich Verkehrswesen.
CONCEPT AND ANALYSIS OF AN INTEGRATED HYDROJET PROPULSION WITH A ROTATION SYMMETRICAL BOUNDARY LAYER INLET Ph.D. Thesis [KONZEPTION UND ANALYSE EINES INTEGRIERTEN STRAHLANTRIEBES MIT EINEM ROTATIONSSYMMETRISCHEN GRENZSCHICHTEINLAUF]
Christian Masilge 1991 86 p In GERMAN
(ETN-92-91161) Avail: NTIS HC/MF A05

Noncontacting laser Doppler velocimetry and traditional pressure probes were used for the measurement of the pulse and energy flows at the single stations of the propulsor. The analysis of the tests, in particular of the influence of blockage effects and of the shock of the jet under water, led to an extension of the project principles around pressure coefficients for the inlet and jet exhaust. ESA

N92-22028# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.
EVALUATION AND QUALIFICATION OF DIFFUSION BRAZE REPAIR TECHNIQUES FOR SUPERALLOY GAS TURBINE COMPONENTS
P. Stoute, D. Manente (Vac-Aero International, Oakville, Ontario), and J.-P. Immarigeon 9 Sep. 1991 34 p Presented at the Symposium on Industrial Application of Gas Turbines, Banff, AB, 16-18 Oct. 1991
(NRC-LTR-ST-1839; CTN-92-60410) Avail: NTIS HC/MF A03

The development of diffusion braze repair (DBR) techniques for service damaged engine nozzle guide vanes (NGVs) made from cobalt and nickel-base superalloys is discussed. A description of the work performed for qualification of the repair techniques for aero engine applications is also provided. This qualification work included bench testing of material test coupons as well as accelerated endurance testing of repaired aero engine parts under simulated service conditions in a burner rig. It was shown that it is possible to closely simulate NGV operating conditions in the laboratory. Thermal fatigue damage typical of service was produced in both new and repaired components. By comparing the response of new and repaired parts to rig testing in terms of crack initiation and growth, it was possible to assess repair durability expediently and at minimal cost. Cracking generally initiated sooner in the repaired NGVs than in new components for leading edge/outer shroud cracks. Although test components incurred severe stress through rig testing, many of the repaired areas looked structurally sound after testing. The results indicated that DBR of cobalt base components is a viable alternative to component replacement.
CISTI

N92-22032*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SPACE STATION FREEDOM DELTA PRESSURE LEAKAGE RATE COMPARISON TEST DATA ANALYSIS REPORT
E. B. Sorensen Feb. 1992 26 p
(NASA-TM-103576; NAS 1.15:103576) Avail: NTIS HC/MF A03 CSCL 11A

Results are provided of a series of tests performed to identify the relationship between gas leakage rates across a seal at various internal to external pressure ratios. The results complement and provide insight into the analysis technique used to obtain the results presented in MSFC SSF/DEV/EL91-008, 'Space Station Freedom (S.S. Freedom) Seal Flaw Study with Delta Pressure Leak Rate Comparison Test Report.' Author

N92-22036* National Aeronautics and Space Administration. Pasadena Office, CA.
BILEVEL SHARED CONTROL FOR TELEOPERATORS Patent
Samad A. Hayati, inventor (to NASA) and Subramanian T. Venkataraman, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 4 Feb. 1992 21 p Filed 11 May 1990 Supersedes N91-13724 (29 - 5, p 670)
(NASA-Case-NPO-17800-1-CU; US-Patent-5,086,400; US-Patent-Appl-SN-522949; US-Patent-Class-395-95; US-Patent-Class-901-6; US-Patent-Class-395-86; Int-Patent-Class-G06F-15/00) Avail: US Patent and Trademark Office CSCL 13I

A shared system is disclosed for robot control including integration of the human and autonomous input modalities for an improved control. Autonomously planned motion trajectories are modified by a teleoperator to track unmodelled target motions, while nominal teleoperator motions are modified through compliance to accommodate geometric errors autonomously in the latter. A hierarchical shared system intelligently shares control over a remote robot between the autonomous and teleoperative portions of an overall control system. Architecture is hierarchical, and consists of two levels. The top level represents the task level, while the bottom, the execution level. In space applications, the performance of pure teleoperation systems depend significantly on the communication time delays between the local and the remote sites. Selection/mixing matrices are provided with entries which reflect how each input's signals modality is weighted. The shared control minimizes the detrimental effects caused by these time delays between earth and space.
Official Gazette of the U.S. Patent and Trademark Office

N92-22043* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HIGH TEMPERATURE, FLEXIBLE, FIBER-PREFORM SEAL Patent
Bruce M. Steinetz, inventor (to NASA) and Paul J. Strocky, inventor (to NASA) 21 Jan. 1992 8 p Filed 9 Nov. 1990
(NASA-Case-LEW-15085-1; US-Patent-5,082,293; US-Patent-Appl-SN-610879; US-Patent-Class-277-3; US-Patent-Class-239-265.11; US-Patent-Class-277-34; US-Patent-Class-277-76; US-Patent-Class-277-229; US-Patent-Class-277-234; Int-Patent-Class-F16J-15/46) Avail: US Patent and Trademark Office CSCL 11A

A seal is mounted in a rectangular groove in a movable structural

panel. The seal comprises a fiber preform constructed of multiple layers of fiber having a uniaxial core. Helical fibers are wound over the core. The fibers are of materials capable of withstanding high temperatures and are both left-hand and right-hand wound. An outer layer wrapped over said helical fibers prevents abrasion damage.

Official Gazette of the U.S. Patent and Trademark Office

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N92-21137# Los Alamos National Lab., NM.
MEASUREMENT CONTROL: PRINCIPLES AND PRACTICE AS APPLIED TO NONDESTRUCTIVE ASSAY
T. E. Sampson Dec. 1991 25 p
(Contract W-7405-eng-36)
(DE92-006834; LA-12233-MS) Avail: NTIS HC/MF A03

This report discusses the principles and practice of measurement control for nondestructive assay (NDA) instruments. Emphasis is placed on the methods used to measure the stability of instruments and the resulting uncertainty information that can be derived from these measurements. NDA is not always blessed with the highly controlled samples that are assumed in the analytical laboratory. This adversely affects the use and applicability of the historical error information from instrument stability checks to estimate measurement uncertainties for the broad range of samples presented to most NDA instruments. DOE

N92-21170# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.
SELF-RATINGS OF EIGHT FACTORS OF QUALITY MANAGEMENT AT NAVAL AVIONICS CENTER
Susan P. Hocevar, Carolyn Applegate, and Kenneth W. Thomas Dec. 1991 54 p
(AD-A245218; NPS-AS-92-005PR) Avail: NTIS HC/MF A04
CSCL 05/1

The focus of this report is the implementation of Total Quality Management in ten DoD organizations. The Participating organizations were all identified by the Federal Quality Institute as either winners or finalists of the Productivity/Quality Management and Budget. Qualitative data collected included interviews with either top executives or TQM coordinators, documentation of quality management activities. A questionnaire survey was also administered to the executive steering committee of each organization providing a self-assessment of eight dimensions of quality management practices. The report describes the lessons learned, promising practices and the results of the self assessment survey for the participating organizations. GRA

N92-21315# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Hauptabteilung Informationstechnik.
THE POSSIBILITIES AND LIMITS OF HIGH SPEED IMAGE PROCESSING [MOEGLICHKEITEN UND GRENZEN DER SCHNELLEN BILDVERARBEITUNG]
Konrad J. Mayer Jul. 1991 18 p In GERMAN; ENGLISH summary
(OEFZS-4588; ETN-92-91104) Copyright Avail: NTIS HC/MF A03

Industrial quality control by means of image processing systems is discussed. Limitations imposed by spatial resolution, production speed, and the complexity of the image processing algorithm are taken into account. The general concept of object and model comparison is discussed. Characteristic features of an image processing system are outlined. Classification of the complexity of an industrial application is carried out. State of the art and trends in image processing technologies are reviewed. ESA

N92-21730# Pratt and Whitney Aircraft, West Palm Beach, FL.
METAL-METAL BONDLINE NDE METHODS Final Report, 1 Oct. 1989 - 28 Feb. 1991
B. A. Weston and L. D. Percival Dec. 1991 17 p
(Contract F33615-89-C-5616)
(AD-A244429; WL-TR-91-4135) Avail: NTIS HC/MF A03
CSCL 13/5

Advanced gas turbine engine concepts are continually striving towards higher thrust to weight ratios. Two methods of achieving this goal are higher compression ratios and weight reduction through use of less material, lighter material, or a combination of the two. Development of integrally bladed rotors (IBR) is a relatively new manufacturing technique that would eliminate the need for the heavier construction of the dovetail area. Integrally bladed rotors require reliable metal to metal bonding (MMB) techniques and the ability to have the bond plane adequately inspected for defects that could reduce bond strength capabilities. The purpose of this program was the validation and refinement of an ultrasonic inspection method for examination of metal-to-metal bonds (MMB) that are representative of those encountered in bonded gas turbine components such as integrally-bladed rotors. The methodology was to be optimized for detection of typical defect conditions such as blown grains and microcracking. To assist in the development of this method, the metal-to-metal (MTM) simulation program, which was developed at Iowa State University, was to provide theoretical guidelines for method optimization. GRA

N92-21846# Rolls-Royce Ltd., Derby (England).
THE ROLLS-ROYCE EXPERIENCE OF TOTAL QUALITY MANAGEMENT
K. Janes 1 Nov. 1990 8 p
(PNR-90815; ETN-92-90783) Copyright Avail: NTIS HC/MF A02

The 'Total Quality' concept, part of a drive to further increase quality awareness within the company and implement a program of operational improvement, is considered. Total quality means continuous improvement of customer satisfaction. The corporate goals agreed to were to provide an awareness of total quality in all employees, to improve operational effectiveness by elimination of waste and to improve customer satisfaction contributing to increased market share. The management of the total quality concept, its first two years of operation, and its development into Project 2000 (a company-wide initiative to create a total quality culture in every aspect of business), are discussed. ESA

N92-22029# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.
INSPECTION OF AIRCRAFT ENGINE COMPONENTS USING AUTOMATED EDDY CURRENT AND PATTERN RECOGNITION TECHNIQUES
A. Fahr, C. E. Chapman, A. Pelletier, and D. R. Hay (Tektrend International, Inc., Montreal, Quebec) 28 Jun. 1991 20 p
(NRC-LTR-ST-1834; CTN-92-60411) Avail: NTIS HC/MF A03

A fully automated inspection and decision making system, which utilizes a standard eddy current (EC) instrument, an automated XYZ table, and an advanced pattern recognition software package, was developed and integrated. The system was used to inspect fastener bolt holes in aircraft engine rotating parts and the preliminary inspection results on a J 85 CAN 40 compressor disc are presented in this report. The effectiveness of pattern recognition in determining defective bolt holes was compared with the conventional visual analysis of EC signals by an experienced operator. The results were verified by pry opening of all the bolt holes and examination under a scanning electron microscope. The use of pattern recognition analysis provided significant improvement in the sensitivity, reliability and speed of inspection. It was possible to indicate the presence of service-induced fatigue cracks as small as 0.05 mm in the bolt holes of a compressor disc in real-time. The correlations between the EC signal amplitude and phase angle with the crack size indicate that both the amplitude and phase information are required to increase the detectability for small cracks. Pattern recognition uses these and other optimal features of the EC signal for improved detection results. CISTI

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N92-21140# Sandia National Labs., Albuquerque, NM.
TRANSIENT DYNAMIC ANALYSIS OF PLATES AND SHELLS WITH PRONTO 3D
V. L. Bergmann Sep. 1991 84 p
(Contract DE-AC04-76DP-00789)
(DE92-006871; SAND-91-1182) Avail: NTIS HC/MF A05

PRONTO 3D is a three-dimensional transient solid dynamics code for analyzing large deformations of highly nonlinear materials subjected to high strain rates. It is a Lagrangian finite element program with explicit integration of the equations of motion through time. This report documents the implementation of a four-scale quadrilateral shell element into Version 6.0 of PRONTO 3D. This report describes the theory, implementation and use of a four-node shell element. Also described are the required architectural changes made to PRONTO 3D to allow multiple element types. Several test problems are documented for verification of the PRONTO 3D implementation and for demonstration of computational savings using shell elements for thin structures. These problems also serve as examples for the user. A complete, updated list of the PRONTO 3D input commands is also included. DOE

N92-21212*# Colorado Univ., Boulder. Dept. of Aerospace Engineering.
COUPLED FLUID-STRUCTURE INTERACTION. PART 1: THEORY. PART 2: APPLICATION Final Report
Carlos A. Felippa and Roger Ohayon (Office National d'Etudes et de Recherches Aerospatiales, Paris, France) Nov. 1991 21 p
(Grant NAG3-934)
(NASA-CR-189061; NAS 1.26:189061) Avail: NTIS HC/MF A03 CSCL 20K

A general three dimensional variational principle is obtained for the motion of an acoustic field enclosed in a rigid or flexible container by the method of canonical decomposition applied to a modified form of the wave equation in the displacement potential. The general principle is specialized to a mixed two-field principle that contains the fluid displacement potential and pressure as independent fields. Semidiscrete finite element equations of motion based on this principle are derived and sample cases are given. Author

N92-21235# GKSS-Forschungszentrum Geesthacht (Germany, F.R.). Inst. for Materials Research.
NUMERICAL SIMULATIONS OF DUCTILE CRACK PROPAGATION GROWTH IN THIN SPECIMENS BASED ON A COHESIVE ZONE MODEL
H. Yuan and A. Cornec 14 Apr. 1991 12 p
(GKSS-91/E/23; ISSN-0344-9629; ETN-92-91010) Copyright Avail: NTIS HC/MF A03

Ductile crack growth in a thin Compact Tension (CT) specimen is numerically simulated using a finite element method based on a cohesive zone model. Numerical results are shown to be in fair agreement with experimental records. It is confirmed that the separation energy based on the cohesive zone model is constant for a homogeneous fracture process and different for normal and shear fracture. Results suggest that separation energy can be used as a single fracture parameter for whole fracture events for both crack initiation and stable crack growth. ESA

N92-21454# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
IMPLEMENTATION OF COMPONENT MODE SYNTHESIS IN THE VAST PROGRAM
M. J. Smith and S. G. Hutton Sep. 1990 115 p Sponsored by Defence Research Establishment Atlantic
(DREA-CR-90-449; CTN-92-60448) Avail: NTIS HC/MF A06

Several variations of component mode synthesis, a procedure for computing the natural frequencies and mode shapes of a structure, are described. These methods treat a structure as an assemblage of components, with each component being transformed to a reduced, modal representation. Synthesis of these components yields a reduced-order eigenvalue problem, from which the lower structural modes can be calculated with high accuracy. This procedure enables complex structures to be reduced to component form. Each component can then be treated individually and modifications to one area do not involve re-analysis of non-modified components. A fixed interface component mode synthesis method is implemented in the computer program, VAST. The method adds free vibration modes of the structural components to the static condensation procedure used in the substructuring/superelement option of the program. Several examples are presented in order to demonstrate the applicability and accuracy of the method. Author (CISTI)

N92-21457*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE EFFECT OF ACCELERATION VERSUS DISPLACEMENT METHODS ON STEADY-STATE BOUNDARY FORCES
D. S. McGhee Washington NASA. Marshall Space Flight Center Apr. 1992 31 p
(NASA-TP-3218; M-686; NAS 1.60:3218) Avail: NTIS HC/MF A03 CSCL 20K

This study describes the acceleration and displacement methods for use in the recovery of coupled system boundary forces. A simple two degree of freedom system has been used for illustration. The effect of the choice of method for use with indeterminate or over-constrained boundaries has been investigated. It has specifically looked at results from a simple two dimensional beam problem using both methods. Much work has been done on the effect of Craig-Bampton modal truncation system displacements and forces, however, little work has been done on system level modal truncation. The findings of this study indicate that the effect of this system level truncation is significant. This may be particularly true for the 35 Hz system cutoff frequency that is required by the space shuttle. From this study's findings, recommendations for areas of study with space shuttle payload systems are made. Author

N92-21460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A HISTORICAL OVERVIEW OF TILTROTOR AEROELASTIC RESEARCH AT LANGLEY RESEARCH CENTER
Raymond G. Kvaternik Apr. 1992 33 p Presented at the Fourth Workshop on Dynamics and Aeroelastic Stability Modeling of Rotorcraft Systems, College Park, MD, 19-21 Nov. 1991 1991
(NASA-TM-107578; NAS 1.15:107578) Avail: NTIS HC/MF A03 CSCL 20K

The Bell/Boeing V-22 Osprey which is being developed for the U.S. Military is a tiltrotor aircraft combining the versatility of a helicopter with the range and speed of a turboprop airplane. The V-22 represents a tiltrotor lineage which goes back over forty years, during which time contributions to the technology base needed for its development were made by both government and industry. NASA Langley Research Center has made substantial contributions to tiltrotor technology in several areas, in particular in the area of aeroelasticity. The purpose of this talk is to present a summary of the tiltrotor aeroelastic research conducted at Langley which has contributed to that technology. Author

N92-21496*# Rockwell International Corp., Canoga Park, CA.
COMPOSITE LOAD SPECTRA FOR SELECT SPACE PROPULSION STRUCTURAL COMPONENTS Final Report
J. F. Newell, H. W. Ho, and R. E. Kurth Nov. 1991 212 p
(Contract NAS3-24382)
(NASA-CR-189072; NAS 1.26:189072; RI/RD90-128) Avail: NTIS HC/MF A10 CSCL 20K

The work performed to develop composite load spectra (CLS) for the Space Shuttle Main Engine (SSME) using probabilistic methods. The three methods were implemented to be the engine system influence model. RASCAL was chosen to be the principal

method as most component load models were implemented with the method. Validation of RASCAL was performed. High accuracy comparable to the Monte Carlo method can be obtained if a large enough bin size is used. Generic probabilistic models were developed and implemented for load calculations using the probabilistic methods discussed above. Each engine mission, either a real fighter or a test, has three mission phases: the engine start transient phase, the steady state phase, and the engine cut off transient phase. Power level and engine operating inlet conditions change during a mission. The load calculation module provides the steady-state and quasi-steady state calculation procedures with duty-cycle-data option. The quasi-steady state procedure is for engine transient phase calculations. In addition, a few generic probabilistic load models were also developed for specific conditions. These include the fixed transient spike model, the poison arrival transient spike model, and the rare event model. These generic probabilistic load models provide sufficient latitude for simulating loads with specific conditions. For SSME components, turbine blades, transfer ducts, LOX post, and the high pressure oxidizer turbopump (HPOTP) discharge duct were selected for application of the CLS program. They include static pressure loads and dynamic pressure loads for all four components, centrifugal force for the turbine blade, temperatures of thermal loads for all four components, and structural vibration loads for the ducts and LOX posts. Author

N92-21702# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
THE 3D-FINITE ELEMENT IMPACT SIMULATION ON CONCRETE STRUCTURES
Norbert Heider 15 Dec. 1989 15 p Presented at the ASME Winter Annual Meeting, San Francisco, CA, 10-15 Dec. 1989
(MBB-UA-1166-89-PUB; ETN-92-90995) Avail: NTIS HC/MF A03

The analysis of impact processes is an interesting application of full three dimensional (3D) Finite Element (FE) calculations. A simulation of the penetration process of a kinetic energy projectile into a concrete target is presented. Such a calculation requires an adequate FE model, especially a proper description of the crack opening process in front of the projectile. The aim is the prediction of the structural survival of the penetrator with the help of an appropriate failure criterion. The computer simulation allows a detailed analysis of the physical phenomena during impact. ESA

N92-21733# Army Natick Research and Development Command, MA. Engineering Center.
FINITE ELEMENT MODELING OF FRAGMENT PENETRATION OF THIN STRUCTURAL COMPOSITE LAMINATES Final Report, 1 Oct. 1988 - 30 Sep. 1991
Andreas M. Blanas Dec. 1991 49 p
(DA Proj. 1L1-61102-AH-52)
(AD-A245069; NATICK/TR-92/019) Avail: NTIS HC/MF A03 CSCL 13/13

Fiber-reinforced composite laminates are increasingly used in tactical shelters for their structural and ballistic resistance properties and to increase survival in the field. The development of analytical techniques to predict the level of ballistic protection provided by composite laminates would greatly enhance the effective use of new materials and composite design concepts. The first stage of the effort involves using the finite element code DYNA3 to macromechanically model the impact, and possible penetration, of a composite shelter wall by fragments from conventional bomb bursts. The model accommodates fragments of different material, shape, grain size, and velocity, and composite walls of different material, ply orientation, areal density, and volume fractions. Input models for fragments and composite laminates, having layup and material configuration similar to experimental models, have been run. Plots of ballistic limit versus areal density for different materials and fragment grain sizes were obtained and compared with experimental results. Parametric studies, measuring the effects of varying input model's material properties on the ballistic limit, were also conducted. GRA

N92-21741# Rolls-Royce Ltd., Derby (England).
APPLICATION OF FINITE ELEMENT METHODS TO FRACTURE MECHANICS
A. C. Pickard and M. J. Walsh 1 Jul. 1990 15 p Presented at the 1st International Conference on Computer-Aided Assessment and Control of Localised Damage, Portsmouth, England, 26-28 Jun. 1990
(PNR-90770; ETN-92-90761) Copyright Avail: NTIS HC/MF A03

The application of three dimensional Finite Element (FE) modeling to the calculation of stress intensity factors is considered. Recommended methods of solution are discussed and reference is made to the need to attain quality standards and consistency of solution through the use of NAFEMS guidelines. For many situations, solutions from standard geometries are inappropriate since they fail to model the component geometry and load distribution accurately. An example of modeling cracks in an aeroengine component feature is given. Recent work has considered the stress intensity around coalescing coplanar fatigue cracks in bend specimens. Finite element models of the specimens used and the methods of analysis are discussed. Microstructurally short cracks were modeled assuming locally nonisotropic material properties and the FE modeling and method of analysis are discussed. ESA

N92-21768# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.
ENERGY ESTIMATES RELATING DIFFERENT LINEAR ELASTIC MODELS OF A CYLINDRICAL SHELL. PART 1: THE MEMBRANE-DOMINATED CASE
J. Piila and J. Pitkaeranta Nov. 1990 28 p
(PB92-133909; RR-A286; ISBN-951-22-0438-X) Avail: NTIS HC/MF A03 CSCL 20K

Three different linear models describing the elastic deformation of a thin cylindrical shell under a given smooth normal pressure distribution are analyzed. A model problem with a membrane-dominated state of deformation is considered. The models studied are: (1) the standard 3-D model; (2) the classical shell model of Koiter-Sanders-Vlasov; and (3) the asymptotic membrane theory of the shell. Estimates are derived relating the deformations fields according to different models in relative energy norm. GRA

N92-21769# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.
ENERGY ESTIMATES RELATING DIFFERENT LINEAR ELASTIC MODELS OF A CYLINDRICAL SHELL. PART 3: THE SOFT MEMBRANE CASE
J. Piila and J. Pitkaeranta Aug. 1991 16 p
(PB92-133966; RR-A299; ISBN-951-22-0758-3) Avail: NTIS HC/MF A03 CSCL 20K

A 'soft' membrane-dominated deformation state of a cylindrical shell with no kinematical constraints is considered. The soft membrane state can arise from a special load type that is not able to excite inextensional deformations. Energy estimates relating the 3-D elastic models with classical shell models as well as with the asymptotic theory are derived. GRA

N92-21792# Technische Hogeschool, Delft (Netherlands).
COMPUTATIONAL MECHANICS: RECENT DEVELOPMENTS IN DIANA
R. DeBorst and D. G. Roddemen 1991 87 p Prepared in cooperation with Instituut TNO voor Bouwmaterialen en Bouwconstructies, Delft, Netherlands Submitted for publication
(PB92-128867) Avail: NTIS HC/MF A05 CSCL 20K

The topics covered include: rate-dependent modeling of concrete fracture; identification of elastic properties by a numerical-experimental method; a mixed element for geometrically and physically nonlinear shell problems; application of linear and nonlinear fracture mechanics options to free edge delamination in laminated composites; and numerical analysis of soil-structure interaction - evaluation and application to cofferdam construction. GRA

N92-21818 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OPTIMAL DESIGN OF GEODESICALLY STIFFENED COMPOSITE CYLINDRICAL SHELLS Ph.D. Thesis
Guy Jean Gendron 1991 221 p
Avail: Univ. Microfilms Order No. DA9204638

An optimization system based on the finite element code CSM Testbed and the optimization program ADS is described. The optimization system can be used to obtain minimum weight designs of composite stiffened structures. Ply thicknesses, ply orientations, and stiffener heights can be used as design variables. Buckling, displacement, and material failure constraints can be imposed on the design. The system is used to conduct a design study of geodesically stiffened shells. For comparison purposes, optimal designs of unstiffened shells and shells stiffened by rings and stringers are also obtained. Trends in the design of geodesically stiffened shells are identified. An approach to include local stress concentrations during the design optimization process is then presented. The method is based on a global/local analysis technique. It uses spline interpolation functions to determine displacements and rotations from a global model which are used as 'boundary conditions' for the local model. The organization of the strategy in the context of an optimization process is described. The method is validated with an example. Dissert. Abstr.

N92-21857 Rensselaer Polytechnic Inst., Troy, NY.
THERMAL STRESSES AND DEFORMATIONS IN COMPOSITE THIN-WALLED AND THICK-WALLED TUBES AND SHELLS Ph.D. Thesis
Naki Tutuncu 1991 165 p
Avail: Univ. Microfilms Order No. DA9202215

Stresses and deformations in composite cylinders and spherical shells are studied. First, thermal twist of thin-walled tubes made of hybrid laminates and the maximization of the thermal twist rate are considered. The twist rate involved both material and geometric parameters. The coefficient of thermal shear, which is a material property, and the cross sectional geometry of the tube, which is a geometric property, are both optimized keeping the hygrothermal degradation of the material and the change in the torsional stiffness of the tube to a minimum. Next, stresses and deformations due to combined and thermal loads in thick-walled composite cylinders are examined. An elasticity solution is used to calculate radial stresses and deformations. It is shown that the radial stress is virtually independent of the ply fiber orientations. The maximum twist rate is found to occur at different angles of fiber orientations, depending on the wall thickness and radius of the cylinder. Finally, stresses and deformations in spherical composite shells subject to internal pressure, and thermal loads are studied in two sections which are briefly described. Dissert. Abstr.

N92-21983*# Draper (Charles Stark) Lab., Inc., Cambridge, MA.
DISCRETE AND CONTINUOUS DYNAMICS MODELING OF A MASS MOVING ON A FLEXIBLE STRUCTURE
Deborah Ann Herman Jan. 1992 152 p
(Contract NAS9-18426)
(NASA-CR-189539; NAS 1.26:189539; CSDL-T-1111) Avail: NTIS HC/MF A08 CSCL 20K

A general discrete methodology for modeling the dynamics of a mass that moves on the surface of a flexible structure is developed. This problem was motivated by the Space Station/Mobile Transporter system. A model reduction approach is developed to make the methodology applicable to large structural systems. To validate the discrete methodology, continuous formulations are also developed. Three different systems are examined: (1) simply-supported beam, (2) free-free beam, and (3) free-free beam with two points of contact between the mass and the flexible beam. In addition to validating the methodology, parametric studies were performed to examine how the system's physical properties affect its dynamics. Author

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N92-21092# Beleidscommissie Remote Sensing, Delft (Netherlands).
AGRISCATT: QUALITY ANALYSIS AND DATA DESCRIPTION OF THE DUTSCAT 1987 DATA
B. A. M. Bouman, M. A. M. Vissers, and D. Uenk (Centre for Agrobiological Research, Wageningen, Netherlands) Jul. 1991 42 p
(BCRS-90-34; ETN-92-90981) Avail: NTIS HC/MF A03

A quality analysis and a visual data interpretation (graphs, figures) were carried out on the DUTSCAT radar data, collected over the Dutch test site in the Flevopolder in 1987 during the Agriscatt campaign. Data interpretation was related to crop type and crop growth of sugarbeet, potato and winter wheat. After rigorous quality analysis, the whole C, X and Ku2 band, all the measurements at 70 degree incidence angle and all field average gamma values with standard deviation greater than 3 dB were removed from the data set (unreliable data). The relative position of the frequency bands was in accordance with general theory: gamma L band less than gamma S band less than gamma Ku1 band. The field average values were well clustered per crop type in all frequency bands, angles of incidence and at all sorties. For each crop type, the angular dependency of gamma was smooth in all frequency bands: with mainly bare soil, gamma decreased a little with increasing incidence angle, and with closed crop cover gamma was more or less horizontal with incidence angle. Crop types and fields of mainly bare soil could be discriminated in the different frequency bands. For mainly bare soil, a combination of the L and the Ku1 band offered the best possibilities for soil type discrimination ('beet soil' and 'potato soil' from 'wheat soil' (70 pct. crop cover)). For crop types, the best combination of frequency bands for discrimination was the L band with the S band. The temporal curves of gamma of the crop types was comparable in trend in all three frequency bands. For beat and potato, gamma increased with crop growth until the midst of the growing season (beginning July). For wheat, no 'radar growth' curves were recognized. The range in gamma with the growth of the crops was generally not very large, i.e., in the order of 4 to 6 dB in all three frequency bands and for all crops (at 40 degree incidence angle). An exception was the L band for potato in which the range was about 10 dB. ESA

N92-21093# Beleidscommissie Remote Sensing, Delft (Netherlands).
ERS-1 DATA DISSEMINATION IN THE NETHERLANDS: A PROPOSAL FOR IMPLEMENTATION OF THE SYSTEM INFRASTRUCTURE
J. P. vanderMeulen and R. W. vanSwol (National Aerospace Lab., Amsterdam, Netherlands) Jul. 1991 104 p
(BCRS Proj. IS-3.11)
(BCRS-91-07; ETN-92-90984) Avail: NTIS HC/MF A06

General information about the ERS-1 mission is given and an infrastructure for the dissemination of ERS-1 data is proposed. Conclusions and recommendations based on the requirements of the Dutch user community are given: requests for observations of Synthetic Aperture Radar (SAR) images, exploratory services concerning the ERS-1 data base at EECF (Earthnet ERS-1 Central

Facility) and all offline data requests will be organized through the NPOC (National Point Of Contact) at the National Aerospace Laboratory (Markness, Netherlands); for cataloging and browse services using the Earthnet connection, the user may visit NLR; reception and display of requested fast delivery SAR imgaes at the NPOC; reception and throughput (or a particular) subset of fast delivery LBR (Low Bit Rate) data (wave and wind data to be received within three hours after observation) to be established at KNMI (Royal Netherlands Meteorological Institute (de Bilt)). A summary of costs to establish the proposed infrastructure is given. ESA

N92-21094# Beleidscommissie Remote Sensing, Delft (Netherlands).
APPLICABILITY OF REMOTE SENSING FOR THE MAPPING OF GEOLOGICAL AND HYDROLOGICAL CHARACTERISTICS IN A SAND REGION Interim Report [TOEPASSINGSMODELEJKHEDEN VAN REMOTE SENSING BIJ DE KARTERING VAN BODEMKUNDIGE EN HYDROLOIGISCHE KENMERKEN IN EEN ZANGEBIED. DEELRAPPORT]
H. A. M. Thunnissen (Winand Staring Centre, Wageningen, Netherlands) Jun. 1991 73 p In DUTCH
(BCRS Proj. OP-2.3)
(BCRS-91-08; ETN-92-90985) Avail: NTIS HC/MF A04

An investigation as to what extent remote sensing pictures can provide information concerning geological and hydrological characteristics in a sand region, based on differences in reflection and/or radiation temperature, is reported. Remote sensing pictures can provide valuable additional information, and are useful in soil mapping and water content mapping. Most information is provided by evaporation pictures deduced from (expensive) digital remote sensing aerial pictures. The substantially cheaper false color pictures, taken under favorable circumstances, can provide valuable additional information for soil mapping. ESA

N92-21116# Beleidscommissie Remote Sensing, Delft (Netherlands).
[ACTIVITIES REPORT OF THE NETHERLANDS REMOTE SENSING BOARD] Annual Report, 1989
1990 145 p In DUTCH; ENGLISH summary
(ETN-92-90902) Avail: NTIS HC/MF A07

The investigation of operational thermal aerial pictures for the Dutch Public Work Department and for meteorology was continued. The usefulness of operational remote sensing for agricultural and nature management was studied. The commercialization possibilities of remote sensing techniques were analyzed. New possible applications of remote sensing were studied, such as phenomenological applications and free space investigations. The studies on radar water observation, radar vegetation observation, optical water remote sensing, and optical land remote sensing were continued. Technological developments were performed. ESA

N92-21156# Boeing Military Airplane Development, Seattle, WA.
UNMANNED AERIAL RECONNAISSANCE VEHICLE (UARV) IMAGERY INTERPRETATION STUDY Final Technical Report, Mar. - Sep. 1990
Stephen J. Anthony, Steven W. Havens, and John W. Buffington Dec. 1991 77 p
(Contract F30602-87-D-0085)
(AD-A245225; RL-TR-91-348) Avail: NTIS HC/MF A05 CSCL 15/4

This study was conducted because the end product of reconnaissance is the intelligence report generated by the interpreter. Without imagery usable by an interpreter, the entire UARV system would be useless. A unique approach was utilized in developing technology requirements for UARVs by first identifying what was required for image interpretation and then propagating these requirements up to the vehicle subsystems level. We conducted the study in four phases. The first phase reviewed image interpreter requirements in terms of image quality needed to perform the specific tasks described by requirements documents. In phase 2, we reviewed UARV subsystems to determine which were critical to the reconnaissance mission. Phase 3 analyzed the systems issues and imagery requirements to determine where technology research and development activities needed to cover the shortfalls. GRA

N92-21214# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING TECHNIQUES TO THE DETECTION AND MAPPING OF FLOODING DYNAMICS WITHIN THE PANTANAL, MATO GROSSO DO SUL STATE, BRAZIL: PRELIMINARY RESULTS
Joao dosSantosViladaSilva (Empresa Brasileira de Pesquisa Agropecuaria, Corumba.) and Hermann J. H. Kux Jun. 1991 15 p Presented at the 24th International Symposium on Remote Sensing of Environment, Rio de Janeiro, Brazil, 27-31 May 1991
(INPE-5329-PRE/1727) Avail: NTIS HC/MF A03

The Pantanal, an extensive floodplain region in Central Western Brazil, is annually flooded. Thematic Mapper scenes (bands 3, 4, and 5) from the dry and flood seasons, were analyzed. The objective is to evaluate the performance of classification algorithms (Maximum Likelihood, K-means, Parallelepiped, Slicing) in order to discriminate four thematic classes (water, flooded areas, wet areas, and dry areas) of interest. An analysis from the results of these classifications is made. The classifier on Maximum Likelihood (MAXVER) showed that in the scene of the dry season, the results were the most consistent, followed by the Density Slicing Classifier at band 4. Recommendations are made for further works on flooding dynamics within this huge ecosystem. Author

N92-21358# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MODELING SUSPENDED SOLIDS CONCENTRATIONS BASED ON TM/LANDSAT-5 IMAGES AT GUANABARA BAY, RJ, BRAZIL
Claudia Zuccari Fern Braga and Alberto W. Setzer Jun. 1991 10 p Presented at the 24th International Symposium on Remote Sensing of Environment, Rio de Janeiro, Brazil, 27-31 May 1991
(INPE-5328-PRE/1726) Avail: NTIS HC/MF A02

A distribution of Total Suspended Solids (TSS) for Guanabara Bay is presented. The distribution was obtained through the expansion of a stepwise regression model that resulted from in situ and TM/LANDSAT-5 data. Water samples from 12 sites in the Bay were collected simultaneously in a TM overpass. TSS was related to nine different TM bands and band combinations through simple correlation analysis. Bands 4 (760-900 nm) and 6 (10400-12500 nm) had statistically significant correlation coefficients ($r = 0.87$ and 0.74 respectively), and were selected for stepwise linear regression analysis. Determination coefficients (r(exp 2)), with a 95 percent confidence level, were 0.69 for dependent variables bands 4 and 6 and 0.72 for band 4 alone. Therefore 72 percent of the TSS variability in the surface water of the Bay is explained by band 4. Based on this result a map of concentration levels for about 400 sq km of estuarine waters at the Bay region was digitally produced in an interactive multispectral image analyzer. The results show a potential application of orbital remote sensing to water quality monitoring and could provide environmental agencies with complementary continuous information for estuarine areas with few or missing water sampling points. Author

N92-21732# Environmental Research Inst. of Michigan, Ann Arbor.
EVALUATION OF CROP RESIDUE MEASUREMENTS USING LANDSAT THEMATIC MAPPER DATA Final Report
R. K. Aggarwala, J. E. Colwell, and R. M. Reinhold Oct. 1991 34 p
(AD-A245068; ERIM-238900-2-F) Avail: NTIS HC/MF A03 CSCL 02/4

The feasibility of using LANDSAT Thematic Mapper (TM) satellite data to measure crop residue was investigated. This project was structured to examine the feasibility of measuring crop residue

from a phenomenological perspective. Initial analyses were performed on reflectance measurements made on pure samples of soil, residue, and green crop which were collected in the field. These analyses led to the development of a two-band (LANDSAT TM bands 5 and 7) reflectance algorithm which was found to be accurate and robust. The reflectance-based algorithm was then converted to an algorithm that could be used on actual LANDSAT TM data. This TM algorithm was implemented on TM data collected on 7 Jun. 1991, and the resulting estimates of percent crop residue in selected fields were compared with field measurements of crop residue in those same fields. TM estimates made it possible to categorize most of the fields into their correct crop residue classes. The results of this project are promising. They suggest that there are relatively robust procedures for using LANDSAT TM data to assist in measuring crop residue. GRA

N92-21829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD. Marine Environmental Lab.

SATELLITE OBSERVATIONS OF MESOSCALE FEATURES IN LOWER COOK INLET AND SHELIKOF STRAIT, GULF OF ALASKA

James D. Schumacher, Willard E. Barber, Benjamin Holt (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and Antony K. Liu May 1991 24 p

(NASA-CR-190050; NAS 1.26:190050; PB92-101633; NOAA-TR-ERL-445; PMEL-40; CONTRIB-1230) Avail: NTIS HC/MF A03 CSCL 08C

The Seasat satellite launched in Summer 1978 carried a synthetic aperture radar (SAR). Although Seasat failed after 105 days in orbit, it provided observations that demonstrate the potential to examine and monitor upper oceanic processes. Seasat made five passes over lower Cook Inlet and Shelikof Strait, Alaska, during Summer 1978. SAR images from the passes show oceanographic features, including a meander in a front, a pair of mesoscale eddies, and internal waves. These features are compared with contemporary and representative images from a satellite-borne Advanced Very High Resolution Radiometer (AVHRR) and Coastal Zone Color Scanner (CZCS), with water property data, and with current observations from moored instruments. The results indicate that SAR data can be used to monitor mesoscale oceanographic features. Author

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N92-21113# Japan Society of Mechanical Engineers, Tokyo.

REPORT OF THE SUBCOMMITTEE MEETING STUDIES ON VARIOUS ENERGY UTILIZATION BY RC95 STIRLING CYCLE EQUIPMENT AND ENVIRONMENTAL CONSERVATION

1991 180 p In JAPANESE

(DE92-771920; ETDE/JP-MF-2771920) Avail: NTIS HC/MF A09

The paper describes the results of the study on Stirling engines (SE) and various methods of heat utilization. The SE is a heat engine which is quiet, high in thermal efficiency, applicable to many heat sources, low on the pollution level, and the subjects for its wide spread are the price and durability. Developments for its commercialization have been made. The paper reports on the results of the 3rd meeting of the subcommittee formed in 1989. The application field of the SE is so wide, that it covers air conditioners, refrigerators, solar thermal conversion, utilization of waste heat and other fuels. Many small temperature difference Stirling engines are reported as characteristic SE. The SE has a bright future including developing countries in its target area. Furthermore, researches on space and ground use solar SE as a high-technology engine are being conducted actively, and refrigeration use Stirling equipment including Vuilleumier cycle has been developed. Some Japanese companies have succeeded in commercialization of air conditioning SE, and are entering into quantity production. DOE

N92-21114# New Energy Development Organization, Tokyo (Japan).

INVESTIGATION OF INTRODUCTION FORM OF LARGE SCALE FUEL CELLS, PART 1

Mar. 1991 209 p In JAPANESE; ENGLISH summary

(DE92-772251; ETDE/JP-MF-2772251) Avail: NTIS HC/MF A10

Investigations are conducted on a large scale phosphoric acid fuel cell (PAFC) power generation system for dispersed use of which immediate introduction is anticipated for the electric utility industry. The studies are made on the development trend, possible capacity for introduction, and optimum introduction/operation form. The operational temperature of PAFC is 200 C. Even on a small scale, PAFC power generation efficiency is high. The overall efficiency can be raised to 70 to 80 percent by the use of exhaust heat. It has good load responsibility and small environmental load. It is predicted that cost of a 5 MW commercial PAFC plant will be 200,000 to 250,000 yen/kW in the year 2000. The possible average introduction capacity will be 1872 MW/year for the coming 20 years, which indicates a considerably large marketability. Sites for installation considered are urban energy centers, substations, isolated islands, etc. In comparison between gas turbines and PAFC to be installed in the urban energy center, PAFC is more advantageous than gas turbines in terms of energy saving and economy if the cost of PAFC is reduced down to 250,000 yen/kW. DOE

N92-21115# New Energy Development Organization, Tokyo (Japan).

INVESTIGATION OF INTRODUCTION FORM OF LARGE SCALE FUEL CELLS, PART 2

Mar. 1991 240 p In JAPANESE

(DE92-772252; ETDE/JP-MF-2772252) Avail: NTIS HC/MF A11

This paper investigates the development of a large-capacity high-performance inverter for fuel cells. To develop such an inverter, large-capacity and high-speed power devices are required, and Gate Turn Off (GTO) thyristors and static induction (SI) thyristors come into play. Estimating the properties of GTO and SI thyristors will be attained by the year 2000, an optimum inverter system using these properties is selected to conceive a concept plan for the inverter. As a result, in the inverter using (GTO) with a low switching frequency, an average value of three phases is to be controlled, and therefore, the inverter is weak in disturbances and imbalances to the power system. Further improvement is required such as a multiple trans-structure needing complicated secondary connections in order to reduce high frequencies. In the case of using the SI thyristor, adopting a relatively high frequency, an instantaneous value control system which controls the current of each phase individually is made possible. The inverter is strong in disturbances and imbalances to the power system. Therefore, in the case of minor ground faults of the power system, the operation can be continued without necessarily stopping the fuel cell power plant. However, development has been made for only small power devices so far. DOE

N92-21148# Sandia National Labs., Albuquerque, NM.

CIRCE2/DEKGEN2: A SOFTWARE PACKAGE FOR FACILITATED OPTICAL ANALYSIS OF 3-D DISTRIBUTED SOLAR ENERGY CONCENTRATORS

Vicente J. Romero 1991 9 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992

(Contract DE-AC04-76DP-00789)

(DE92-004215; SAND-91-1439C; CONF-920436-17) Avail: NTIS HC/MF A02

CIRCE2 is a cone-optics computer code for determining the flux distribution and total incident power upon a receiver, given concentrator and receiver geometries, sunshape (angular distribution of incident rays from the sun-disk), and concentrator imperfections such as surface roughness and random deviation in slope. Statistical methods are used to evaluate the directional distribution of reflected rays from any given point on the concentrator, whence the contribution to any point on the target can be obtained. DEKGEN2 is an interactive preprocessor which facilitates specification of geometry, sun models, and error distributions. The CIRCE2/DEKGEN2 package equips solar energy engineers with a quick, user-friendly design and analysis tool for study/optimization of dish-type distributed receiver systems. The package exhibits convenient features for analysis of 'conventional' concentrators, and has the generality required to investigate complex and unconventional designs. Among the more advanced features are the ability to model dish or faceted concentrators and stretched-membrane reflectors, and to analyze 3-D flux distributions on internal or external receivers with 3-D geometries. Facets of rectangular, triangular, or circular projected shape, with profiles of parabolic, spherical, flat, or custom curvature can be handled. Provisions for shading, blocking, and aperture specification are also included. This paper outlines the features and capabilities of the new package, as well as the theory and numerical models employed in CIRCE2. DOE

N92-21211# National Academy of Sciences - National Research Council, Washington, DC. Committee on the National Energy Modeling System.

THE NATIONAL ENERGY MODELING SYSTEM

1992 159 p

(Contract DE-AC01-90PE-79065)

(LC-91-68549; ISBN-0-309-04634-3; S-476) Avail: NTIS HC/MF A08

The DOE uses a variety of energy and economic models to forecast energy supply and demand. It also uses a variety of more narrowly focussed analytical tools to examine energy policy options. For the purpose of the scope of this work, this set of models and analytical tools is called the National Energy Modeling System (NEMS). The NEMS is the result of many years of development of energy modeling and analysis tools, many of which were developed for different applications and under different assumptions. As such, NEMS is believed to be less than satisfactory in certain areas. For example, NEMS is difficult to keep updated and expensive to use. Various outputs are often difficult to reconcile. Products were not required to interface, but were designed to stand alone. Because different developers were involved, the inner workings of the NEMS are often not easily or fully understood. Even with these difficulties, however, NEMS comprises the best tools currently identified to deal with our global, national and regional energy modeling, and energy analysis needs. D.R.D.

N92-21336# Midwest Research Inst., Golden, CO.

HIGH-EFFICIENCY CADMIUM AND ZINC-TELLURIDE-BASED THIN-FILM SOLAR CELLS

A. Rohatgi, R. Sudharsanan, and S. Ringel (Georgia Inst. of Tech., Atlanta.) Feb. 1992 82 p

(Contract DE-AC02-83CH-10093)

(DE92-001198; NREL/TP-214-4580) Avail: NTIS HC/MF A05

This report describes research into polycrystalline CdTe solar cells grown by metal-organic chemical vapor deposition. Efficiencies of approximately 10 percent were achieved using both p-i-n and p-n structures. A pre-heat treatment of CdS/SnO2/glass substrates at 450 C in hydrogen atmosphere prior to the CdTe growth was found to be essential for high performance because this heat treatment reduces oxygen-related defects from the CdS surface. However, this treatment also resulted in a Cd-deficient CdS surface, which may in part limit the CdTe cell efficiency to 10 percent due to Cd vacancy-related interface defects. Preliminary model calculations suggest that removing these states can increase the cell efficiency from 10 to 13.5 percent. Photon absorption in the CdS film also limits the cell performance, and eliminating this loss mechanism can result in CdTe efficiencies in excess of 18 percent. Polycrystalline, 1.7-e, CdZnTe films were also grown for tandem-cell applications. CdZnTe/CdS cells processed using the standard CdTe cell fabrication procedure resulted in 4.4 percent efficiency, high series resistance, and a band-gap shift to 1.55 eV. The formation of Zn-O at and near the CdZnTe surface is the source of high contact resistance. A saturated dichromate each prior to contact deposition was found to solve the contact resistance problem. The CdCl2 treatment was identified as the cause of the observed band-gap shift due to the preferred formation of ZnCl2. DOE

N92-21337# Midwest Research Inst., Golden, CO.

OVERVIEW OF NREL'S PHOTOVOLTAIC ADVANCED R/D PROJECT

T. Surek Jan. 1992 13 p Presented at the 6th International Photovoltaic Science and Engineering Conference, New Delhi, India, 10-14 Feb. 1992

(Contract DE-AC02-83CH-10093)

(DE92-001214; NREL/TP-410-4723; CONF-920227-4) Avail: NTIS HC/MF A03

The National Renewable Energy Laboratory's (NREL's) Photovoltaic Advanced Research and Development (PV AR & D) Project supports the U.S. Department of Energy's National Photovoltaics Program in assisting the development and commercialization of photovoltaics (PV) energy technology. The NREL program is implemented through in-house research and subcontracts, with over 50 percent of the annual budget awarded through competitive solicitations to universities, large and small businesses, and other research centers. These activities include cost-shared, multiyear, government/industry partnerships, and technology initiatives. The research has resulted in a better fundamental understanding of materials, devices, and processes, the achievement of record efficiencies in nearly all PV technology areas, the identification of promising new approaches to low-cost photovoltaics, and the introduction of new PV technology products into system experiments and PV markets. This paper presents an overview of NREL's PV AR & D Project in terms of project organization and budgets, near- and long-term project objectives, research participants, and current and future research directions. Recent progress in the in-house and subcontracted research activities is described. DOE

N92-21546*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

HIGH ALTITUDE SOLAR POWER PLATFORM

M. D. Bailey and M. V. Bower (Alabama Univ., Huntsville.) Apr. 1992 91 p

(NASA-TM-103578; NAS 1.15:103578) Avail: NTIS HC/MF A05 CSCL 10B

Solar power is a preeminent alternative to conventional aircraft propulsion. With the continued advances in solar cells, fuel cells, and composite materials technology, the solar powered airplane is no longer a simple curiosity constrained to flights of several feet in altitude or minutes of duration. A high altitude solar powered platform (HASPP) has several potential missions, including communications and agriculture. In remote areas, a HASPP could be used as a communication link. In large farming areas, a HASPP could perform remote sensing of crops. The impact of HASPP in continuous flight for one year on agricultural monitoring mission is presented. This mission provides farmers with near real-time data twice daily from an altitude which allows excellant resolution on water conditions, crop diseases, and insect infestation. Accurate, timely data will enable farmers to increase their yield and efficiency. A design for HASPP for the foregoing mission is presented. In the design power derived from solar cells covering the wings is used for propulsion, avionics, and sensors. Excess power produced midday will be stored in fuel cells for use at night to maintain altitude and course. Author

N92-21573# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ADVANCES IN HIGH TEMPERATURE COMPONENTS FOR AMTEC (ALKALI METAL THERMAL-TO-ELECTRIC CONVERTER)
R. M. Williams, B. Jeffries-Nakamura, M. L. Underwood, M. A. Ryan, D. OConnor, and S. Kikkert 1991 6 p Presented at the 26th Intersociety Energy Conversion Engineering Conference, Boston, MA, 3-9 Aug. 1991
(Contract DE-AI01-86CE-90237)
(DE92-006752; CONF-910801-26) Avail: NTIS HC/MF A02

Long lifetimes are required for AMTEC (or sodium heat engine) components for aerospace and terrestrial applications, and the high heat input temperature as well as the alkali metal liquid and vapor environment places unusual demands on the materials used to construct AMTEC devices. In addition, it is important to maximize device efficiency and power density, while maintaining a long life capability. In addition to the electrode, which must provide both efficient electrode kinetics, transport of the alkali metal, and low electrical resistance, other high temperature components of the cell face equally demanding requirements. The beta(double prime) alumina solid electrolyte (BASE), the seal between the BASE ceramic and its metallic transition to the hot alkali metal (liquid or vapor) source, and metallic components of the device are exposed to hot liquid alkali metal. Modification of AMTEC components may also be useful in optimizing the device for particular operating conditions. In particular, a potassium AMTEC may be expected to operate more efficiently at lower temperatures. DOE

N92-21831# Mechanical Technology, Inc., Latham, NY.
STIRLING ENGINE NATURAL GAS COMBUSTION DEMONSTRATION PROGRAM Final Report, Oct. 1989 - Jan. 1991
W. Ernst, J. Moryl, and G. Riecke Feb. 1991 70 p
(Contract GRI-5090-243-1960)
(PB92-108802; MTI-91TR16; GRI-91/0062) Avail: NTIS HC/MF A04 CSCL 10B

Fueled on natural gas, the Stirling engine is an inherently clean, quiet, and efficient engine. With increasing environmental concern for air quality and the increasingly more stringent requirements for low engine exhaust emissions, the Stirling may be an attractive alternative to internal combustion (IC) engines. The study has demonstrated that ultra low emissions can be attained with a Stirling-engine-driven electric generator configured to burn natural gas. Combustion parameters were optimized to produce the lowest possible exhaust emissions for a flame-type combustor without compromising overall engine thermal efficiency. A market application survey and manufacturing cost analysis indicate that a market opportunity potentially exists in the volumes needed to economically manufacture a newly designed Stirling engine (Mod 3) for stationary applications and hybrid vehicles. The translation of such potential markets into actual markets does, however, pose difficult challenges as substantial investments are required. Also, the general acceptance of a new engine type by purchasers requires a considerable amount of time. Author

N92-21977*# Solar Kinetics, Inc., Dallas, TX.
DEVELOPMENT OF AN IMPROVED MIRROR FACET FOR SPACE APPLICATIONS Final Report
Paul Schertz, Shabbar Saifee, and Luke Lammert Oct. 1991 98 p
(Contract NAS3-25632)
(NASA-CR-189109; NAS 1.26:189109) Avail: NTIS HC/MF A05 CSCL 10A

A fabrication technique was successfully developed for a metallic aluminum honeycomb, high-accuracy, lightweight, and long-life solar concentrator (mirror) for Advanced Solar Dynamic Space Power Systems. The program scope was limited to the development, fabrication, evaluation, and delivery of a solar concentrator facet (petal) that was sized for a 2-meter deployable solar concentrator. A surface accuracy of 1.0 mrad was achieved. The development incorporated tooling design, material selection, facet forming, adhesive selection, testing, and analysis. Techniques for applying levelizing, reflective, and protective optical coatings were also developed. Author

N92-22037* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SELECTIVE EMITTERS Patent
Donald L. Chubb, inventor (to NASA) 14 Jan. 1992 8 p Filed 30 Mar. 1990 Supersedes N91-13802 (29 - 5, p 684)
(NASA-Case-LEW-14731-1; US-Patent-5,080,724;
US-Patent-Appl-SN-503486; US-Patent-Class-136-253;
Int-Patent-Class-H01C-31/58) Avail: US Patent and Trademark Office CSCL 10A

This invention relates to a small particle selective emitter for converting thermal energy into narrow band radiation with high efficiency. The small particle selective emitter is used in combination with a photovoltaic array to provide a thermal to electrical energy conversion device. An energy conversion apparatus of this type is called a thermo-photovoltaic device. In the first embodiment, small diameter particles of a rare earth oxide are suspended in an inert gas enclosed between concentric cylinders. The rare earth oxides are used because they have the desired property of large emittance in a narrow wavelength band and small emittance outside the band. However, it should be emphasized that it is the smallness of the particles that enhances the radiation property. The small particle selective emitter is surrounded by a photovoltaic array. In an alternate embodiment, the small particle gas mixture is circulated through a thermal energy source. This thermal energy source can be a nuclear reactor, solar receiver, or combustor of a fossil fuel.
Official Gazette of the U.S. Patent and Trademark Office

N92-21269*# Boston Coll., Chestnut Hill, MA. Inst. for Space Research.
LUNAR PRODUCTION AND APPLICATION OF SOLAR CELLS, AND SYNTHESIS OF DIAMOND FILM Final Report
P. H. Fang *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N92-21260# Environmental Protection Agency, Washington, DC. Office of Information Resources Management.
INFOTERRA/USA DIRECTORY OF ENVIRONMENTAL SOURCES Final Report
Oct. 1991 470 p
(PB92-102433; EPA/IMSD-91/014) Avail: NTIS HC/MF A20 CSCL 13B

The INFOTERRA/USA Directory of Environmental Sources, previously entitled the U.S Directory of Environmental Sources, is the 5th edition of a directory of 445 United States environmental organizations (sources) registered with the INFOTERRA/USA National Focal Point. INFOTERRA is the international environmental information exchange network coordinated by the United Nations Environment Program (UNEP). Sources listed in the directory have agreed to provide environmental information free of charge or at a minimum fee to international requestors. Each entry contains contact information, fields of environmental expertise, and a description of services. The sources are grouped by the type of organization originating the information. For ease of access, both alphabetical and subject indexes are provided.
Author

N92-21339# Westinghouse Hanford Co., Richland, WA.
MODERN AND PLEISTOCENE CLIMATIC PATTERNS IN THE WEST

K. L. Petersen Dec. 1991 32 p
(Contract DE-AC06-87RL-10930)
(DE92-006437; WHC-EP-0523) Avail: NTIS HC/MF A03

This document was prepared as a chapter entitled, 'Modern and Pleistocene Climatic Patterns in the West,' for the two volume book, The Biogeography of the Great Basin and Colorado Plateau, being edited by Dr. Wilford M. Hess (Brigham Young University, Provo, Utah) and is scheduled to be published in 1992 by Westview Press (Boulder, Colorado). It was prepared in support of the Climate Change Task of the Protective Barrier Program. This document shows that regional climate cannot be viewed in isolation, but must be viewed as part of a larger continental and global system to fully understand the underlying driving mechanism. This document is an attempt to provide the global and continental contexts. These contexts are necessary for the overall project of which this is a part. The overall object of this task is to obtain quantitative estimates of past, present, and especially future climate in the Pacific Northwest and the Western United States. These estimates which will be used in future papers are needed to aid in the development of a defensible Hanford Site Protective barrier design and Hanford Site Performance Assessment, and in proposals to help in the development of protective barriers at the Idaho National Engineering Laboratory and at the DOE's Monticello (Utah) Remedial Action Project for uranium mill tailings. The defensibility of estimates of potential future climate in the Pacific Northwest and the Western United States is greatly enhanced by demonstrating an understanding of the present climate system and the range of change that has occurred in the past. DOE

N92-21395# New Energy Development Organization, Tokyo (Japan).
SURVEY ON THE EFFECTIVE USE OF CARBON DIOXIDE RELATED TO THE GLOBAL ENVIRONMENTAL ISSUES (APPLICATION TO EOR TECHNOLOGY USING CARBON DIOXIDE)
Mar. 1991 168 p In JAPANESE; ENGLISH summary
(DE92-769373; NEDO-ITE-9001) Avail: NTIS HC/MF A08

An effective method for using carbon dioxide injection into oil reservoirs for the fixation of carbon dioxide and its application to enhanced oil recovery (EOR) are presented. EOR using CO2 is widely used as a tertiary recovery technique, particularly in the U.S. In the oil recovery, some of the CO2 is generated as associated gas. The CO2 is separated from the associated gas and recovered for recycling. It is possible to make the carbon dioxide fixation a completely closed system. The CO2 volume required for EOR is estimated at 63 billion tons worldwide. The study introduces a total system for CO2 emission in Japan. The system covers CO2 recovery, liquefaction, and maritime transportation of the liquid CO2 to oil producing countries. The price of CO2 under the total system is higher than that of CO2 emitted from the ordinary carbon dioxide gas field. However, when deduction for a cost of the CO2 fixation to prevent the global warming is taken into consideration, the EOR system using CO2 is economically viable, if the CO2 cost for EOR operation in southeast Asia does not include the cost of CO2 recovery and liquefaction in the total system. However, it is necessary to consider economy and viability individually and check the response to the EOR at each oil field. DOE

N92-21438# Environmental Research Lab., Narragansett, RI.
EPA'S ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM: AN ECOLOGICAL STATUS AND TRENDS PROGRAM
J. F. Paul, F. Holland, J. K. Summers, S. C. Schimmel, and K. J. Scott 1991 22 p Presented at the 7th Annual Aquatic Toxicity Workshop, Vancouver, British Columbia, 5-7 Nov. 1990 Prepared in cooperation with Versar, Inc., Columbia, MD Submitted for publication
(PB92-121169; ERLN-1349; EPA/600/D-91/250) Avail: NTIS HC/MF A03 CSCL 13B

The U.S. Environmental Protection Agency has initiated the Environmental Monitoring and Assessment Program (EMAP) to monitor the status and trends of the nation's near coastal waters, forests, wetlands, agroecosystems, surface waters, and arid lands. The program is also intended to evaluate the effectiveness of the Agency policies at protecting ecological resources occurring in these systems. Monitoring data collected for all these natural resources will be integrated for national status and trends assessments. The country's near coastal resources have been regionalized and classified, an integrated sampling strategy has been developed, and quality assurance/quality control procedures and data management designs have been implemented. Monitoring studies are discussed. Author

N92-21439# National Geophysical Data Center, Boulder, CO.
GLOBAL ECOSYSTEMS DATABASE. VERSION 0.1 (BETA-TEST). EPA GLOBAL CLIMATE RESEARCH PROGRAM. NOAA/NGDC GLOBAL CHANGE DATABASE PROGRAM. PROTOTYPE 1: DATABASE DOCUMENTATION. NGDC KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 25. USER'S MANUAL
W. G. Campbell and J. J. Kineman Nov. 1991 368 p Prepared in cooperation with ManTech Environmental Technology, Inc., Corvallis, OR
(PB92-122803; EPA/600/8-91/216) Avail: NTIS HC/MF A16 CSCL 13B

The primary objective of the cooperative research and development is to produce an integrated, quality controlled, global database (including time sequences) for spatially distributed modeling. The project concentrates on modern observational data, including remotely sensed data and data from other sources. The database includes complementary multi-thematic data sets on comparable grids, registered to a common origin and projection (latitude-longitude). The database has been structured to be operable with several existing geographic information systems (GIS), so that a complete analytical package could be provided to reviewers and other scientists for evaluation, experimentation, and further development. The software accompanying the CD-ROM (a subset of GIS known as Idrisi) was developed and adopted for the project at Clark University. Although compatible with Idrisi, the database is also designed to be easily up-loaded to the GIS known as GRASS, running on UNIX operating systems. Since the database structure is as system independent as possible, tt should also be easily usable in other systems. Author

N92-21462# Denver Univ., CO. Atmospheric Science Center.
REMOTE SENSING ENHANCED MOTOR VEHICLE EMISSIONS CONTROL FOR POLLUTION REDUCTION IN THE CHICAGO METROPOLITAN AREA: SITING AND ISSUE ANALYSIS Final Report
C. E. Lyons and D. H. Stedman Oct. 1991 75 p Sponsored in part by Illinois Dept. of Energy and Natural Resources
(PB92-123769; IL/ENR/RE/AQ-91/15) Avail: NTIS HC/MF A04 CSCL 13B

Three specific scenarios for the implementation of remote sensing to enhance inspection and maintenance programs for controlling motor vehicle emissions are described. Screening at centralized stations, mobile sensors, and modular fixed sensors scenarios describe the range of potential applications of a Fuel Efficiency Automobile Test (FEAT) remote sensor to motor vehicles emission control. A combination of two or all three scenarios would be the most effective in identifying high mileage gross polluting vehicles. The preliminary implementation of each scenario is described. Remote sensing of vehicle emissions to identify the small percentage of vehicles responsible for most of the motor vehicle pollution can contribute to an effective air pollution control strategy that can be implemented. Author

N92-21486# Deeco, Inc., Cary, NC.
METHOD 25: DETERMINATION OF TOTAL GASEOUS NONMETHANE ORGANIC EMISSIONS AS CARBON FROM STATIONARY SOURCES
W. G. DeWees, G. Howe, and D. vonLehmden 31 May 1991 143 p Prepared in cooperation with Research Triangle Inst., Research Triangle Park, NC

(Contract EPA-68-D1-0009)
(PB92-113026; EPA/600/8-91/209) Avail: NTIS HC/MF A07 CSCL 13B

The procedures and specifications for determining volatile organic compounds as total gaseous non-methane organics from stationary sources are described. An emission sample is withdrawn from the stack at a constant rate through a heated filter and a chilled condensate trap by means of an evacuated sample tank. After sampling is completed, the total gaseous nonmethane organics are determined by independently analyzing the condensate trap and sample tank fractions and combining the analytical results. The organic content of the condensate trap fraction is determined by oxidizing the nonmethane organics (NMO) to CO2 and quantitatively collecting the effluent in an evacuated vessel. Then a portion of the CO2 is reduced to CH4 and measured by a flame ionization detector (FID). The organic content of the sample tank fraction is measured by injecting a portion of the sample into a gas chromatographic column to separate the NMO from carbon monoxide (CO), CO2, and CH4; the NMO are oxidized to CO2, reduced to CH4, and measured by an FID. Quality assurance guidance is provided. Author

N92-21487# Environmental Protection Agency, Newport, OR. Bioaccumulation Team.
COMPUTERIZED RISK AND BIOACCUMULATION SYSTEM (VERSION 1.0)
Henry Lee, II, Martha Winsor, Judy Pelletier (AScI Corp., McLean, VA.), and Robert Randall Nov. 1991 27 p
(Contract EPA-68-CO-0051)
(PB92-114164; EPA/600/3-91/069; ERLN-N196) Avail: NTIS HC/MF A03 CSCL 13B

The Computerized Risk and Bioaccumulation System (CRABS, Version 1.0) is an expert system that predicts tissue residues of 15 neutral organic pollutants in sediment dwelling organisms and the human cancer risk from consumption of the contaminated shellfish. Bioaccumulation from bedded sediment can be predicted from the thermodynamic partitioning, first order kinetic, or toxicokinetic model. All the models can predict steady-state tissue residues, while the two kinetic models can predict non-steady state uptake or elimination. CRABS then predicts the lifetime human cancer risk from consumption of clams and other nonmobile sediment dwelling organisms containing the predicted (or measured) tissue residue. The linearized multistage model is used to predict cancer risk for a single pollutant from a single species diet. The program guides the user in estimating shellfish consumption rates if no site-specific rates are available. CRABS is designed to promote thorough documentation of the assumptions and data as well as to error check the entered values. Author

N92-21488# Environmental Protection Agency, Cincinnati, OH. Reduction Engineering Lab.
STORM AND COMBINED SEWER POLLUTION CONTROL: A COMPILATION OF SIGNIFICANT REFERENCES
R. Field, comp. and F. Everson, comp. (Foster Wheeler Enviresponse, Inc., Edison, NJ.) May 1991 34 p
(PB92-114560; EPA/600/9-91/012) Avail: NTIS HC/MF A03 CSCL 13B

Presented here is an overview of the Storm and Combined Sewer Pollution Control Research Program (SCSP). These selected abstracts comprise a fraction of the research performed over a 20-year period, beginning in the mid-1960's. These descriptions serve as a guide for using the collection. A matrix is provided which targets subject content for each report or reprint, and serves as a handy locator. As controls to reduce water pollution have for traditional point sources have been implemented, it became more evident that diffuse sources of pollutants, including discharges from separate storm drainage systems and combined sewer overflows (CSO), are major causes of water quality problems. In response to this situation, Congress required the U.S. Environmental Protection Agency to regulate stormwater discharges to protect water quality by establishing comprehensive programs for permit application, guidance, and management and treatment requirements. Author

N92-21491# ManTech Environmental Technology, Inc., Corvallis, OR.
ESTIMATING CRITICAL LOADS OF SULFATE TO SURFACE WATERS IN THE NORTHEASTERN US: A COMPARATIVE ASSESSMENT OF THREE PROCEDURES FOR ESTIMATING CRITICAL LOADS OF SULFATE FOR LAKES
P. W. Shaffer, B. Rosenbaum, G. R. Holdren, T. C. Strickland, and M. K. McDowell Nov. 1991 44 p Prepared in cooperation with Oak Ridge National Lab., TN; and Science Applications International Corp., Oak Ridge, TN Sponsored in part by Corvallis Environmental Research Lab., OR; and DOE, Washington, DC
(Contract DE-AC05-84OR-21400)
(PB92-119015; EPA/600/3-91/062) Avail: NTIS HC/MF A03 CSCL 13B

The objective of the U.S. critical loads program has been the development of a framework for estimating critical loads and evaluating the effects of multiple assumptions inherent in those estimates. A general framework for developing critical loads estimates was developed by the United Nations Economic Community for Europe (UNECE) in 1990. Examples are given of efforts to estimate critical loads of sulfate for surface waters in the United States. The effects of different assumptions on final estimates are discussed. The results presented here represent a first step in the critical evaluation of models used to estimate critical loads and to cross-validate model based estimates. The results demonstrated substantial variability in critical loads estimated using different data sets and procedures. It seems clear that extensive review, refinement, and verification of models and data sets will be required before any critical load estimates can be reliably used. Author

N92-21569# Pacific Northwest Lab., Richland, WA.
ATMOSPHERIC DISPERSION IN MOUNTAIN VALLEYS AND BASINS
K. J. Allwine Jan. 1992 204 p
(Contract DE-AC06-76RL-01830)
(DE92-006635; PNL-7922; ASCOT-91-8) Avail: NTIS HC/MF A10

The primary goal of the research is to further characterize and understand dispersion in valley and basin atmospheres. A secondary, and related goal, is to identify and understand the dominant physical processes governing this dispersion. This has been accomplished through a review of the current literature, and analyses of recently collected data from two field experiments. This work should contribute to an improved understanding of material transport in the atmospheric boundary layer. It was found that dispersion in a freely draining valley (Brush Creek valley, CO) atmosphere is much greater than in an enclosed basin (Roanoke, VA) atmosphere primarily because of the greater wind speeds moving past the release point and the greater turbulence levels. The development of a cold air pool in the Roanoke basin is the dominant process governing nighttime dispersion in the basin, while the nighttime dispersion in the Brush Creek valley is dominated by turbulent diffusion and plume confinement between the valley sidewalls. The interaction between valley flows and above ridgetops flows is investigated. A 'ventilation rate' of material transport between the valley and above ridgetop flows is determined. This is important in regional air pollution modeling and global climate modeling. A simple model of dispersion in valleys, applicable through a diurnal cycle, is proposed. DOE

N92-21583# Gas Research Inst., Chicago, IL.
PIPELINE CORRIDORS THROUGH WETLANDS: IMPACTS ON PLANT AND AVIAN DIVERSITY, BOREAL WETLANDS, OCONTO COUNTY, WISCONSIN
R. E. Zimmerman, E. D. Pentecost, G. D. VanDyke, and C. T. Hackney Nov. 1991 55 p Prepared in cooperation with Argonne National Lab., IL
(Contract W-31-109-eng-38)
(DE92-006556; GRI-91/0046) Avail: NTIS HC/MF A04

A study was conducted to quantify the impacts of a 20-year-old pipeline right-of-way (ROW) through a boreal forest wetland in Oconto County, Wisconsin. Two study sites were selected where

the wetland extended more than 1000 m (3300 ft) along the pipeline, was at least 100 m (330 ft) wide, and extended at least 50 m (165 ft) in both directions from the center of the ROW. Study-specific methodologies were developed to collect and analyze soil, topographic, hydrologic, vegetative, and avian data. The study showed the following: (1) the types of natural wetland areas adjacent to the ROW were not altered; (2) the restriction of water sheet flow that occurred at one site has been reversed by nature; (3) none of the nonnative plant species found on the ROW have invaded the adjacent natural areas; (4) the ROW has provided edges and open water typically lacking in boreal forest wetland that increase both plant and animal species diversity and provide habitat for two sensitive species (the sandhill crane and the showy ladyslipper); (5) three-quarters of the ROW area sampled has been and continues to be wetland, while one-quarter of the ROW area sampled is upland, which increases the diversity of the area; and (6) the permit requirement to provide free access to the public has had a detrimental effect on the vegetative cover on the ROW. DOE

N92-21743# Rolls-Royce Ltd., Derby (England).
ENVIRONMENTALLY SOUND
M. J. T. Smith and K. Goddard 1 Oct. 1990 14 p Presented at the 3rd Annual Conference in Techno-Economic Issues, London, England, 31 Aug. 1990
(PNR-90776; ETN-92-90764) Copyright Avail: NTIS HC/MF A03

Developments made in stage 2 aircraft since 1989 are reviewed. In brief, the events are as follows: the first stage 2 aircraft to be reengined with a stage 3 Rolls-Royce Tay has flown; the first order for stage 3 Tay engines to replace stage 2 Pratt and Whitney JT8Ds in the Boeing 727 has been secured; Europe has decided on its future policy in the phase out of the stage 2 fleet; airports around the world have progressively tightened their stranglehold in stage 2 operations; it has become clear that simple hushkits are only marginal stop gap methods of hiding from tommorrow's environmental problems; concern about atmospheric pollution has cast another shadow over the old engines now powering the stage 2 fleet; Rolls-Royce is re-examined the development of a large Tay engine directed at the re-engining market. ESA

N92-21764# Technische Hogeschool, Delft (Netherlands). Faculty of Geodetic Engineering.
TROPOSPHERIC EFFECTS ON BASELINE MEASUREMENTS BY USING (GPS) SATELLITES
J. C. deMunck Jun. 1991 30 p
(PB92-133164; Rept-91.3) Avail: NTIS HC/MF A03 CSCL 13B

Discussed here is the influence of different aspects of tropospheric refraction on the accuracy of the components of a near horizontal terrestrial baseline measured by radio satellites. In particular, double difference measurement by the Global Positioning System (GPS) is considered. The most important effect appears to be caused by the difference of the total water vapor contents over the end points of the baseline. For a baseline of 100km, the troposphere can cause an error in height difference up to about 10 cm in a moderate climate; the error in horizontal direction might be 4 cm. In a humid tropical climate, the errors can be considerably larger. Author

N92-21779# National Ocean Service, Rockville, MD. Office of Oceanography and Marine Assessment.
SECOND SUMMARY OF DATA ON CHEMICAL CONTAMINANTS IN SEDIMENTS FROM THE NATIONAL STATUS AND TRENDS PROGRAM Progress Report
Apr. 1991 155 p
(PB92-119072; NOAA-TM-NOS-OMA-59) Avail: NTIS HC/MF A08 CSCL 13B

The National Oceanic and Atmospheric Administration (NOAA) National Status and Trends (NS&T) Program analyzed samples of surface sediment collected at almost 300 coastal and estuarine sites throughout the United States since 1884. Here, analysis of a later and larger data set indicates that most of the highest concentrations of surface sediments for any particular sediment are found at sites near urban areas of Boston, New York, San Diego, Los Angeles and Seattle. The overall concentration distributions for each contaminant are approximately lognormal, allowing a definition of 'high' concentrations as those exceeding the mean plus one standard deviation of the lognormal distribution. Those 'high' concentrations are useful for comparisons within the NS&T data set and with other reports on sediment contamination. The 'high' concentrations in units of microgram/g of dry fine-grained sediment for each contaminant are (in parenthesis): Ag(1.2), As(24), Cd(1.2), Cr(230), Cu(84), Hg(0.49), Pb(89), Sn(8.5), Zn(270), LMWPAH(1.0), HMWPAH(3.0), tDDT(0.037), and tPCB(0.20). Author

N92-21832# Radian Corp., Research Triangle Park, NC.
URBAN AIR TOXICS MONITORING PROGRAM, 1990
Jun. 1991 285 p
(Contract EPA-68-08-0014)
(PB92-110022; EPA/450/4-91/024) Avail: NTIS HC/MF A13 CSCL 13B

From March 1990 through February 1991 samples of ambient air were collected at 12 sites in the eastern part of the U.S. Every 12 days, air was integrated over 24-hour periods into passivated stainless steel canisters. Simultaneously, air was drawn through cartridges containing dinitrophenylhydrazine to collect carbonyl compounds. The samples were analyzed at a central laboratory for a total of 37 halogenated and aromatic hydrocarbons, formaldehyde, and other oxygenated species. The hydrocarbon species were analyzed by gas chromatography/multiple detectors and gas chromatography/mass spectrometry, while the carbonyl species were analyzed by liquid chromatography. Complete data for all the hydrocarbon samples are presented. Author

N92-21854 Maine Univ., Orono.
EVALUATION OF OZONE DEPOSITED TO A CONIFEROUS FOREST Ph.D. Thesis
Zhou Guan 1991 248 p
Avail: Univ. Microfilms Order No. DA9205581

Because there is no method to measure ozone deposition quantitatively, much current effort is concentrated on inferential methods. In these methods, ozone concentration in the atmosphere are coupled with evaluated deposition velocity, v(sub d), or its reciprocal, the total resistance, R(sub t), to yield estimates of ozone deposition. Difficulties arise concerning the estimation of R(sub t). A multi-resistance model is presented here, in which R(sub a) (aerodynamic resistance), R(sub b) (quasi-linear boundary layer resistance) and R(sub c) (canopy resistance) were discussed separately, and then combined to approximate R(sub t) for ozone transfer. The model is based on the assumption that the major sink of ozone is in leaves. The dynamic characteristics of the atmosphere and surface are discussed based on momentum flux density data. It has been found that atmospheric stability above the coniferous forest is close to the neutral conditions. Consequently, a neutral model was used for estimating R(sub a), and results were compared with outputs from the Hicks model, which uses routine meteorological measurements to estimate R(sub a). The results of R(sub a) from the Hicks model were considerably improved using a new threshold suggested in the study to identify the atmospheric stability. A close relationship between the surface dynamic parameters, d, zero plane displacement, and z(sub 0), roughness length, has been found and expressed as a set of equations by which the parameters can be determined uniquely corresponding to wind speed after d is chosen as 0.6 to 0.8 of mean height of the forest. The inferred values of R(sub b) and R(sub c) from the Penman-Monteith equation are also improved after improvement of R(sub a). The Penman-Monteith equation and the Hicks model were employed for estimating R(sub c). Generally, accuracy of R(sub c) is better using the first method than the latter, but the Penman-Monteith equation depends on the accuracy of latent heat flux density, which is not a routine measurement. Accuracy of R(sub c) obtained from the Hicks model can be improved by optimization of the model parameters. Ozone flux estimates from the Penman-Monteith equation approximates

measurements better than from the Hicks model, but both underestimate ozone flux. It seems that there are exterior sinks for ozone deposition. Dissert. Abstr.

N92-21270*# Houston Univ., Clear Lake, TX. Dept. of Biological and Allied Health Sciences.
EVALUATION OF FUNGAL METABOLIC COMPOUNDS RELEASED TO THE AIR IN A RESTRICTED ENVIRONMENT Final Report
Robert N. Ferebee *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 7 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 13B

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N92-21203# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
AN APPROACH FOR PARAMETERIZING MESOSCALE PRECIPITATING SYSTEMS
M. J. Weissbluth and W. R. Cotton 1991 4 p Presented at the 5th Conference on Mesoscale Processes, Atlanta, GA, 5-10 Jan. 1992
(Contract DE-FG02-90ER-61066)
(DE92-007205; DOE/ER-61066/4; CONF-920174-2) Avail: NTIS HC/MF A01

A cumulus parameterization laboratory has been described which uses a reference numerical model to fabricate, calibrate and verify a cumulus parameterization scheme suitable for use in mesoscale models. Key features of this schemê include resolution independence and the ability to provide hydrometeor source functions to the host model. Thus far, only convective scale drafts have been parameterized, limiting the use of the scheme to those models which can resolve the mesoscale circulations. As it stands, the scheme could probably be incorporated into models having a grid resolution greater than 50 km with results comparable to the existing schemes for the large-scale models. We propose, however, to quantify the mesoscale circulations through the use of the cumulus parameterization laboratory. The inclusion of these mesoscale drafts in the existing scheme will hopefully allow the correct parameterization of the organized mesoscale precipitating systems. DOE

N92-21231# Goettingen Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftlichen Fachbereich.
INVERSE TASKS FOR THREE DIMENSIONAL ELECTROMAGNETIC INDUCTION PROBLEMS IN GEOPHYSICAL APPLICATIONS Ph.D. Thesis [UMKEHRAUFGABEN BEI 3D ELEKTROMAGNETISCHEN INDUKTIONSPROBLEMEN IN GEOPHYSIKALISCHEN ANWENDUNGEN]
Zonghou Xiong 1990 81 p In GERMAN
(ETN-92-91004) Avail: NTIS HC/MF A05

The construction, stability, ambiguity, and application possibilities for three dimensional geoelectromagnetic inversion, are described. It is shown that efficient inverse methods can be constructed, using Tikhonov regularization. Dispersion current inversion methods and linearization methods can help in finding quick solutions for inverse problems. Advantages of both methods are emphasized. The introduction of quasi-exact and quasi-testing data allows a theoretical investigation, using computerized simulation. Regularization is to be used for ill-posed problems. Comparisons with results of other programs show that methods and programs can be operated error free. ESA

N92-21236# GKSS-Forschungszentrum Geesthacht (Germany, F.R.). Inst. fuer Physik.
A RAY TRACING TECHNIQUE FOR CALCULATING THE SCATTERING PROPERTIES OF ATMOSPHERIC ICE CRYSTALS Thesis - Cologne Univ. [STREUUNG ELEKTROMAGNETISCHER STRAHLUNG AN ATMOSPHAERISCHEN EISKRISTALLEN]
A. Macke 21 Feb. 1991 122 p In GERMAN; ENGLISH summary
(GKSS-91/E/24; ISSN-0344-9629; ETN-92-91011) Copyright Avail: NTIS HC/MF A06

Within the limitations of geometric optics, a ray tracing technique is used to calculate the scattering properties of hexagonal ice crystals. The spectral change of the scattering behavior in the solar and terrestrial range is taken into account as is the influence of different atmospheric crystal sizes and shapes. Both the scattering behavior and the polarization state of the scattered radiation are found to vary strongly with the elevation angle of the radiation source. The influence of high absorption attenuates the forward scattering intensity. In the presence of high absorption, reflection is more pronounced. ESA

N92-21252*# Maryland Univ., College Park. Inst. for Physical Science and Technology.
GLOBAL ELECTRIC FIELD DETERMINATION IN THE EARTH'S OUTER MAGNETOSPHERE USING CHARGED PARTICLES Progress Report No. 1, 1991
T. Eastman, R. Sheldon, D. Hamilton, and C. McIlwain (California Univ., San Diego.) 31 Mar. 1992 15 p
(Grant NAG5-1558)
(NASA-CR-190145; NAS 1.26:190145) Avail: NTIS HC/MF A03 CSCL 04A

Although many properties of the Earth's magnetosphere have been measured and quantified in the past 30 years since it was discovered, one fundamental (for a zeroeth order magnetohydrodynamic (MHD) equilibrium) measurement was made infrequently and with poor spatial coverage: the global electric field. This oversight is in part due to the difficulty of measuring a plasma electric field, and in part due to the difficulty of measuring a plasma electric field, and in part due to the neglect of theorists. However, there is renewed interest in the convection electric field, since it has been realized that it is vital for understanding many aspects of the magnetosphere: the global MHD equilibrium, reconnection rates, Region 2 Birkeland currents, magnetosphere-ionosphere coupling, ring current and radiation belt transport, substorm injections, acceleration mechanisms, etc. Unfortunately the standard experimental methods have not been able to synthesize a global field (excepting the pioneering work of McIlwain's geostationary models), and we are left with an overly simplistic theoretical field, the Volland-Stern electric field mode. Again, single point measurements of the plasma pause were used to infer the appropriate amplitudes of the model, parameterized by Kp (Maynard & Chen, JGR 1975). Although this result was never intended to be the definitive electric field model, it has gone nearly unchanged for 15 years. However, the data sets being taken today require a great deal more accuracy than can be provided by the Volland-Stern model. Nor has the variability of the electric field shielding been properly addressed, although effects of penetrating magnetospheric electric fields has been seen in mid- and low-latitude ionospheric data sets. The growing interests in substorm dynamics also requires a much better assessment of the electric fields responsible for particle injections. Thus, we proposed and developed algorithms for extracting electric fields from particle data taken in the earth's magnetosphere. As a test of the effectiveness of these techniques, we analyzed data taken by the AMPTE/CCE spacecraft in equatorial orbit between 1984-1988. Some analytic tools had to be developed before construction of computer algorithms, and they are discussed.
Author

N92-21398# Los Alamos National Lab., NM.
GEOCHEMICAL EVIDENCE FOR WANING MAGMATISM AND POLYCYCLIC VOLCANISM AT CRATER FLAT, NEVADA

F. V. Perry and B. M. Crowe 1991 11 p Proposed for presentation at the International High Level Radioactive Waste Management (IHLRWM) Conference, Las Vegas, NV, 12-16 Apr. 1992
(Contract W-7405-eng-36)
(DE92-007420; LA-UR-92-329; CONF-920430-52) Avail: NTIS HC/MF A03

Petrologic and geochemical studies of basaltic rocks in the Yucca Mountain region are currently focused on understanding the evolution of volcanism in the Crater Flat volcanic field and the mechanisms of polycyclic volcanism at the Lathrop Wells volcanic center, the youngest center in the Crater Flat volcanic field. Geochemical and petrologic data indicate that the magma chambers which supplied the volcanic centers in Crater Flat became situated at greater crustal depths as the field evolved. Deep magma chambers may be related to a waning magma flux that was unable to sustain upper crystal magma conduits and chambers. Geochemical data from the Lathrop Wells volcanic center indicate that eruptive units identified from field and geomorphic relationships are geochemically distinct. The geochemical variations cannot be explained by fractional crystallization of a single magma batch, indicating that several magma batches were involved in the formation of the Lathrop Wells center. Considering the low magma flux in the Yucca Mountain region in the Quaternary, the probability of several magma batches erupting essentially simultaneously at Lathrop Wells in considered remote. It is more likely that the Lathrop Wells center was formed by a series of eruptions that took place over many thousands of years. The geochemical data from Lathrop Wells is consistent with the concept of a complex, polycyclic volcano, which was originally proposed based on geomorphic and soil-development data. DOE

N92-21412# Cincinnati Univ., OH. Dept. of Physics.
AN INVESTIGATION IN ATMOSPHERIC DYNAMICS AND ITS EFFECTS ON OPTICAL EMISSIONS Final Report, Feb. 1987 - Jun. 1991
T. F. Tuan 1 Aug. 1991 200 p
(Contract F19628-87-K-0023)
(AD-A244504; PL-TR-91-2193) Avail: NTIS HC/MF A09 CSCL 04/1

This report describes theoretical research and modeling on the properties of small-scale gravity waves and on the response of mesospheric and lower thermospheric airglow to gravity waves. The work on small-scale waves has shown that the variation of the Brunt period with altitude, combined with Doppler shifting by background winds, can lead to fully guided modes (Brunt-Doppler ducting). The dependence of the modal properties on phase-velocity dispersion, wind shear, viscosity, and instability is investigated. It is also shown that, for small-scale waves, pressure, density, and temperature changes are due primarily to buoyancy forces. Theoretical work on airglow response to gravity waves has emphasized calculation of the nonlinear response of both the airglow volume emission rate and the airglow column brightness to a gravity wave (local and integrated responses). These calculations are carried out in both the Eulerian and Lagrangian frames. Finally, results of observation of OH airglow wave structures in Maui during the ALOHA 90 campaign are described. GRA

N92-21426 Colorado Univ., Boulder.
ROCKET MEASUREMENTS OF SELF-ABSORPTION OF THE NITRIC OXIDE (1,0) GAMMA BAND IN THE DAYTIME THERMOSPHERE Ph.D. Thesis
Francis Gerard Eparvier 1991 161 p
Avail: Univ. Microfilms Order No. DA9206607

The purpose of this dissertation is to describe and analyze sounding rocket observations of the ultraviolet fluorescent emissions of the nitric oxide molecule in the lower thermospheric dayglow. Nitric oxide (NO) is a minor constituent in the atmosphere, yet it plays important roles in the chemistry and temperature of the upper atmosphere. The rocket experiment was a ultraviolet spectrometer which measured the NO gamma bands in the spectral region from 2120 to 2505 A with a resolution of 2 A. The flight occurred at approximately noon and took limb-viewing spectra of the airglow between 90 and 185 km altitude. Several NO gamma bands were visible at all altitudes of the flight, along with emission features of N2, O(+), and N(+). The data are modelled with synthetic spectra and used as diagnostics of NO concentrations and temperatures. The resonant NO (1,0) gamma band emissions are shown to be attenuated at low altitudes relative to the expected emission rates predicted from comparison with other gamma bands. The self-absorption model is used to fit the (1,0) gamma band observations. The self-absorption theory is presented in detail, and the results are applicable to other column emission measurements of the (1,0) band. Finally, the NO concentrations observed by the sounding rocket experiment are compared with the results of a photochemical model of odd nitrogen in the thermosphere. Dissert. Abstr.

N92-21731# RDP, Inc., Waltham, MA.
IONOSPHERIC MODEL ASSESSMENT USING TRANSIT DATA Scientific Report No. 2
Andrew J. Mazzella, Jr., John G. Casserly, Michael B. Delorey, and James R. Hughes 14 Jun. 1991 28 p
(Contract F19628-89-C-0079)
(AD-A244455; RDP-TR-9101; PL-TR-91-2162; AD-E200826; SR-2)
Avail: NTIS HC/MF A03 CSCL 04/1

Total Electron Content (TEC) measurements derived from observation of polar-orbiting TRANSIT satellites were incorporated into an assessment of the Bent ionospheric model, as implemented for the PAVPAW program. Both temporal and spatial assessments of the ionospheric model were performed. By suitable adaptation of the programs developed for this assessment, similar assessments of other ionospheric models could be performed. GRA

N92-21748# Oxford Univ. (England). Dept. of Engineering Science.
HOW THE DILATANCY OF SOILS AFFECTS THEIR BEHAVIOUR
G. T. Houlsby 1991 16 p Presented at the 10th European Conference on Soil Mechanics and Foundation Engineering, Florence, Italy, 28 May 1991
(OUEL-1888/91; Soil-Mech-Rept-121/91; ETN-92-91084) Avail: NTIS HC/MF A03

The relationships between the friction angle, dilation angle, density and pressure in a granular material are explored. The link between friction and dilation is well established, but quantitative expressions of the dependence of dilation in density and pressure are less well known. A new relationship based on the concepts of critical state soil mechanics is suggested. The types of problem in which dilation plays an important role are then examined, and it is seen that dilatancy increases in significance for heavily constrained problems. The influence of dilation in the capacity of piles is treated in more detail. Additional topics treated include the generalization of dilation expressions. ESA

N92-21855 Georgia Inst. of Tech., Atlanta.
A STUDY OF OZONE EDDY TRANSPORTS IN THE WINTER MIDDLE ATMOSPHERE Ph.D. Thesis
Nai-Yung Christina Hsu 1991 154 p
Avail: Univ. Microfilms Order No. DA9206086

The importance of the eddy transport of ozone in determining the zonally averaged ozone distribution of winter stratosphere is demonstrated utilizing the results of a modified version of a three-dimensional model by Cunnold et al (1975), especially in the region of transition between dynamic control and photochemical control of ozone, where the ozone changes due to the eddy transports are shown to dominate those due to the mean circulation. The contributions of the chemical eddy transports are significant to the net ozone eddy transports by standing planetary waves in the transition region. As a result, using the universal constant diffusion tensor which is derived under the assumption of negligible photochemistry will lead to a significant error in the simulated mean ozone distribution of the two-dimensional models at altitudes between 30 and 45 km. The comparison of the model net ozone

eddy fluxes due to standing planetary wavenumber 1 and 2 and those calculated from the formulation of Garcia and Solomon (1983) based on linear theory, indicates that the contribution of the nonlinear terms of the eddy tracer continuity equation and thermodynamic equation plays an essential role on the net ozone eddy transports by stationary Rossby waves, even when they are small compared to the linear stationary terms. The relative importance of stationary wavenumber 2 on the ozone changes in comparison with stationary wavenumber 1 is also discussed.
Dissert. Abstr.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N92-21164# Naval Postgraduate School, Monterey, CA.
METEOROLOGICAL FEATURES DURING PHASE 1 OF THE COORDINATED EASTERN ARCTIC EXPERIMENT (CEAREX) FROM 17 SEPTEMBER 1988 TO 7 JANUARY 1989 M.S. Thesis
Stephanie W. Hamilton Mar. 1991 98 p
(AD-A245194) Avail: NTIS HC/MF A05 CSCL 04/2

The synoptic and mesoscale meteorological conditions were analyzed for Phase 1 of the Coordinated Eastern Arctic Experiment (CEAREX) from 17 September 1988 to 7 January 1989. Meteorological observations from a research ship (R/V Polarbjoern), an array of drifting buoys and satellite imagery from DMSP and NOAA satellites were the primary tools for analysis. Several short periods of high cyclone activity followed by long periods of high pressure dominated the weather pattern in the eastern Arctic Ocean from Greenland to Novaya Zemlya for this period. Two case studies are presented. An infrequent cyclogenesis event that formed within a strong baroclinic zone over Arctic pack ice was observed in a baroclinic leaf on satellite imagery. Ship and drifting buoy observations provided critical insight to the location and intensity of the leaf's subsequent vertical development to the surface. In the second study, a boundary layer front was observed in the East Greenland Sea by satellite imagery. The front then moved northeast into Fram Strait and a polar low formed at the northern end of the front. The event lasted less than 24 h and would not have been observed except through satellite imagery. GRA

N92-21169# State Univ. of New York, Albany.
MICROPHYSICAL STUDIES OF NOCTILUCENT CLOUDS Final Technical Report
Bernard Vonnegut Jan. 1992 5 p
(Contract N00014-85-K-0705)
(AD-A245216) Avail: NTIS HC/MF A01 CSCL 04/2

We conclude from our experiments that the ice particles present in noctilucent clouds may often exhibit cubic habit. It appears even possible that high tropospheric ice crystals may occasionally exhibit such habit. That would be consistent with rare, but reliable observations of the Scheiner's halo. In the case of noctilucent clouds, however, it is doubtful that the crystal habit is after all of much practical importance, because due to low growth rates and limited duration of supersaturation at the mesopause, the crystals must be very small. Ice crystals of dimensions much smaller than the wavelength of transmitted electromagnetic waves interact with the waves as Rayleigh scatterers, which allows for fairly simple theoretical treatments of the interactions. No refraction or surface reflection would be occurring. It appears that even after a few days of growth noctilucent cloud particles are still only a fraction of a micron in diameter. That is less than or equivalent to the wavelength of visible light. GRA

N92-21207# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TELECONNECTIONS IN THE RELATIVE VORTICITY FIELD DURING THE SUMMER OF 1979/1980 M.S. Thesis
Guillermo Oswaldo Ob Parraga Jun. 1991 94 p In PORTUGUESE; ENGLISH summary
(INPE-5308-TDI/458) Avail: NTIS HC/MF A05

The spatial teleconnections and temporal variability of the relative vorticity during the Southern Hemisphere summer of 1979/1980 are analyzed using National Meteorological Center (NMC) wind data at the 200 hPa level in the horizontal domain limited by the meridians 0 degrees and 180 degrees W and the latitudes 19.6 degrees N and 44.6 degrees S. Spectral and cross spectral analyses of the relative vorticity time series show that the 30-60 days, 15-12 days, 8.5-7.5 days and 4.8-5.7 days periods are significant. Three filtered time series were obtained: (1) periods beyond 6 days removed; (2) periods greater than 10 days; and (3) periods between 30-60 days maintained in the time series. These filtered time series exhibit strong variability in the southeastern part of Brazil, associated to the South Atlantic Convergence Zone (SACZ). Extratropical perturbations are the main driving mechanism of the dynamic of the Bolivian High (BH), SACZ and the South Pacific Convergence Zone (SPCS). Strong positive correlation is observed between the relative vorticity in the SACZ and the Tropical Upper Tropospheric Atlantic Low (TUTAL). The SACZ and TUTAL are strongly modulated in longer periods (greater than 10 dias), and the teleconnections between the SPCZ and the SACZ are also evident. Rotated Principal Components Analysis revealed that the SPCZ and SACZ are interrelated. Teleconnections at the 30-60 days period show strong signals propagating from the SPCZ towards the SACZ and apparently propagating towards to TUTAL region. Author

N92-21290# GKSS-Forschungszentrum Geesthacht (Germany, F.R.). Inst. fuer Physik.
FREQUENCY SHIFTING BY MEANS OF STIMULATED RAMAN SCATTERING FOR ATMOSPHERIC TEMPERATURE AND HUMIDITY DETERMINATION WITH A KrF LASER Thesis - Hamburg Univ. [ERZEUGUNG FREQUENZVERSCHOBENER STRAHLUNG FUER EIN TEMPERATUR- UND FEUCHTE-LIDAR MIT EINEM KRF-LASER UNTER AUSNUTZUNG STIMULIERTER RAMANSTREUUNG]
M. Krause 26 Feb. 1991 119 p In GERMAN; ENGLISH summary
(GKSS-91/E/26; ISSN-0344-9629; ETN-92-91012) Copyright Avail: NTIS HC/MF A06

For the measurement of atmospheric temperature and humidity profiles with a solar blind Raman lidar, it is shown that a shift of the 248 nm KrF laser radiation to longer wavelengths can significantly improve the lidar range. Stimulated Raman Scattering (SRS) is investigated as a means of achieving this goal. With narrow linewidth excitation, first Stokes SRS photon conversion efficiencies of 32, 40, and over 50 percent are achieved in CO2, D2, and H2 at pressures of 3, 4, and 1.5 bar respectively. Competing processes such as stimulated Brillouin scattering and stimulated rotation-vibration Raman scattering are discussed. ESA

N92-21293# Maryland Univ., College Park. Dept. of Meteorology.
A COMPARISON OF SYSTEMATIC ERRORS IN AFGL AND COLA FORECAST MODELS Final Report, 8 Mar. 1988 - 8 May 1991
Anandu D. Vernekar, Jiayu Zhou, and Benjamin Kirtman Jun. 1991 83 p
(Contract F19628-88-K-0015)
(AD-A244458; PL-TR-91-2164; AD-E200794) Avail: NTIS HC/MF A05 CSCL 04/2

Forecast errors exhibit the characteristics of approximations in simulating dynamical and physical processes in models. The models are very complex and hence it is not always possible to identify the approximations responsible for any particular error pattern in forecasts. A comparison between the models' forecast performances can be valuable in isolating the causes of error patterns. Here a comparison of forecast errors in the AFGL and COLA models is made with the intent of identifying the causes of forecast errors. The two models are based on identical approximations in simulating the dynamical processes and only minor differences in parameterizations of the physical processes. Nine ten-day forecasts are made to study the error characteristics in the two models. The errors in the 500 mb geopotential height

are negative in tropics and positive in extratropics. The temperatures at 850 mb are colder than observed in tropics and warmer than observed in extratropics. At 150 mb the temperatures are warmer than observed in tropics and colder than observed in extratropics. These qualitative error characteristics are not only common to these two models, but are also common in the NMC, GFDL, and ECMWF forecast models. The difference in the error structure between the two models is the magnitude of the error in tropics. The tropical error in the AFGL model is larger than than in the COLA model. GRA

N92-21515# Arizona Univ., Tucson. School of Renewable Natural Resources.
SEVERE, SUSTAINED DROUGHT IN THE SOUTHWESTERN US Final Report
F. Gregg and D. H. Getches 1991 557 p Sponsored in part by Colorado Univ., Boulder; and US Man and the Biosphere Program, Washington, DC
(Grant CU-1753-800554)
(PB92-115013) Avail: NTIS HC/MF A24 CSCL 04B

Analysis of tree ring data indicate that the Southwestern United States has experienced droughts in the past of much greater severity and duration than any of recent memory. It is reasonable to expect that droughts on this scale will occur again. The ability of the Southwest to cope with a severe, sustained drought affecting the Colorado River and the major rivers of northern California is examined here. Longterm hydrologic data reconstructed from tree rings is coupled with legal and institutional analyses to determine the likelihood and magnitude of future droughts, and the impacts on water supplies and water quality. The analysis indicates that while the vast storage capacity of the Colorado River provides a significant drought cushion, the region could be made more draught tolerant by improved water management policies. Author

N92-21539 Pennsylvania State Univ., University Park.
REGIONAL CLIMATE CHANGES IN THE GODDARD INSTITUTE FOR SPACE STUDIES GENERAL CIRCULATION MODEL Ph.D. Thesis
Bruce Charles Hewitson 1991 121 p
Avail: Univ. Microfilms Order No. DA9204213

Anthropogenic increases of infrared reactive gases in the atmosphere are leading to changes in the global system. These changes will be manifest in the climate to different degrees from region to region. Consequently there is a pressing need for regional climate change predictions, which has not been met by traditional analog or computer modeling prediction techniques. An alternative approach is developed here which combines elements of General Circulation Models (GCM) with analogs of relationships derived from observed data. This approach provides both a powerful diagnostic tool for GCMs as well as information about possible regional climate change. Using the Goddard Institute for Space Studies (GISS) GCM, the surface synoptic circulation is analyzed with Principal Components Analysis (PCA), and shows that the GCM accurately represents the primary modes of variance in the circulation field. Furthermore, the same modes of variance are present in the 1 x CO2 and 2 x CO2 simulations. Transfer functions based on observed data are then derived for these regions to relate surface climate to synoptic circulation patterns, and are applied to the circulation patterns in 1 x CO2 2 x CO2 GCM simulations. The results demonstrate that while GISS GCM has an accurate representation of the surface synoptic circulation features, the model derived temperature field has strong spatial biases when compared to the field derived from circulation. Furthermore, the temperature field derived from circulation is far more representative of observed data than is the model field itself. When differencing the temperature fields derived from the 1 x CO2 and 2 x CO2 simulations, the regional climate change shows marked differences to that derived by the model. Dissert. Abstr.

N92-21791# National Oceanographic Data Center, Washington, DC.
MARINERS WEATHER LOG, VOLUME 35, NUMBER 4. FALL 1991 Quarterly Report
R. M. DeAngelis 1991 93 p
(PB92-133388) Avail: NTIS HC/MF A05; also available SOD HC $3.50 as 703-029-00028-1 CSCL 04B

The topics covered include: Great Lakes special issues; Lake Superior's wicked November storms; the silent killer - hypothermia; North Coast navigation; guardians of the eighth seas; marine weather review; North Atlantic Ocean; North Pacific Ocean; and pressure and track charts. GRA

N92-21814# National Oceanic and Atmospheric Administration, Rockville, MD. Federal Coordinator for Meteorological Services and Supporting Research.
DOPPLER RADAR METEOROLOGICAL OBSERVATIONS. PART A: SYSTEM CONCEPTS, RESPONSIBILITIES, AND PROCEDURES (INTERIM VERSION ONE)
Jun. 1991 56 p
(PB92-105964; FCM-H11A-1991) Avail: NTIS HC/MF A04 CSCL 04B

The purpose of the Federal Meteorological Handbook (FMH) Number 11 is to standardize the operation of the Weather Surveillance Radar - 1988, Doppler (WSR-88D) units and procedures used by personnel of the Departments of Commerce, Defense, and Transportation. FMH No. 11 is applicable to the WSR-88D only. Part A provides an introduction to the entire handbook, including the restatement of some policy, definitions of terms, and agencies' functions and responsibilities under the WSR-88D System Concept. It provides a listing of the geographical location of known or planned units; prescribes the relative priorities for product generation, so as to assure availability to all users; and sets requirements for national archiving. Authority for change to adaptation parameters is established, as are defaults for certain operational parameters and menus. Author

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N92-21750# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
DISSIPATIVE WAVES EXCITED BY INTERNAL WAVES IN THE THERMOCLINE: PHASE-INTEGRAL CALCULATION OF COUPLING
R. M. Jones and W. H. Hooke Sep. 1991 49 p
(PB92-123918; NOAA-TM-ERL-WPL-210) Avail: NTIS HC/MF A03 CSCL 08C

Thre authors suggest that the sheets of temperature and current gradients observed in the thermocline represent the wavefronts of dissipative waves (viscous and thermal conduction waves). The authors show that in the presence of observed gradients such coupling should be strong enough for these dissipative waves to be as ubiquitous in the thermocline as the internal gravity waves that produce them. The simple picture accounts for the following observed properties of the sheets: (1) their nearly ubiquitous presence in the thermocline; (2) their nearly horizontal orientation; (3) the small vertical spacing (several meters) separating the sheets; (4) variability in that spacing in both height and time; and (5) the high shears and temperature gradients associated with these sheets. An additional result is that coupling of internal gravity waves to dissipative waves may be a more efficient method of dissipation of the energy of internal waves than direct dissipation by the loss term in the refractive index for internal gravity waves. Author

N92-21751 Juszko Scientific Services, Victoria (British Columbia).
ANALYSIS OF THE WEST COAST WAVE CLIMATE WITH APPENDICES 1, 2, AND 3
Barbara-Ann Juszko 31 Mar. 1990 393 p

(DREA-CR-90-424; CTN-92-60406) Avail: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec J8X 3X2, Canada

Surface displacement spectra, collected at five locations off Canada's west coast over a period extending from 1984 to 1989, were used to describe the overall wave climate, spectral types and storm characteristics of this region. Offshore waters experienced the most severe wave climate, as indicated by the joint occurrence of significant wave height (HSIG) and peak period (TP). Conditions of HSIG greater than 8 m and TP greater than 13 s were observed in all locations while the most severe record was represented by an HSIG greater than 13 m and TP of 20 s. Examination of spectral types indicated a large percentage of swell dominant and multiple peak spectra. Fifteen storms, driven by both small and large scale pressure systems, were examined in detail and showed the presence of rapid sea growth (maximum rates of 1 m/hr and 1 s/hr for HSIG and TP). The Ochi and Hubble six-parameter model was fit to all spectra. The statistical distribution of the fit parameters was calculated and an attempt was made to predict these parameters with varying success. The probability distribution of the fit parameters was also examined to define design spectra known confidence limits. Author (CISTI)

N92-21836# Minerals Management Service, Metaire, LA. OCS Regional Office.

GULFPLOT: OCEANOGRAPHIC CHARTING SOFTWARE FOR THE GULF OF MEXICO, VERSION 3.1 Final Report

M. L. Brown Aug. 1991 75 p

(PB92-119593; OCS/MMS-91/0067) Avail: NTIS HC/MF A04 CSCL 08C

Instructions are given for using a public domain, uncompiled GWBASIC computer code that operates as a simple charting 'sketchpad' on a DOS microcomputer. The program allows the user to draw 'standard' or user specified charts of the Gulf of Mexico and to overlay them with various data files constructed according to a simple specification. Both programmatic information, such as survey lines and oceanographic stations, and general ocean conditions, such as frontal locations and drifting buoy trajectories, can be drawn. The program has been widely used by oceanographers working in the Gulf of Mexico, due to its previous draft release on the GULF.MEX electronic bulletin board. Author

N92-21985# Beleidscommissie Remote Sensing, Delft (Netherlands).

THE ASSIMILATION OF SATELLITE AND IN SITU DATA IN A TEMPERATURE MODEL OF THE NORTH SEA

A. C. Bijlsma, H. F. P. vandenBoogaard, and A. C. deSmet (Utrecht State Univ., Netherlands) Aug. 1991 82 p

(Contract BCRS-4531/TO-1.5)

(BCRS-91-24; ETN-92-91103) Avail: NTIS HC/MF A05

A pilot study on the application of remotely sensed Sea Surface Temperatures (SST) and supporting in situ measurements in combination with a numerical temperature model of the North Sea is reported. The study aimed at providing knowledge and experience on the processing, interpretation, and application of satellite thermal infrared (TIR) images in view of the operationalization of TIR and other remote sensing techniques in future. Experiments showed that within the limitations of the model, datasets and computational power, the data assimilation system works for applications with measured data in the North Sea as well. The approach is concluded to be feasible for practical applications. The additional value of satellite SST images with respect to datasets consisting of in situ data only, is based on the improved spatial and temporal coverages (not-with-standing the cloud cover) of the data. Therefore, by the inclusion of satellite SST data, more accurate description of the temperature field can be obtained. ESA

N92-21311*# Alma Coll., MI. Dept. of Chemistry.

MOVEMENT OF TRACE ELEMENTS DURING RESIDENCE IN THE ANTARCTIC ICE: A LABORATORY SIMULATION Final Report

Melissa M. Strait *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p

(For primary document see N92-21300 12-99)

Avail: NTIS HC/MF A09 CSCL 08L

51 LIFE SCIENCES (GENERAL)

N92-21328# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

INHALATION TOXICOLOGY. 12: COMPARISON OF TOXICITY RANKINGS OF SIX POLYMERS BY LETHALITY AND BY INCAPACITATION IN RATS Final Report

Donald C. Sanders, Boyd R. Endecott, and Arvind K. Chaturvedi Dec. 1991 10 p

(AD-A244599; DOT/FAA/AM-91/17) Avail: NTIS HC/MF A02 CSCL 06/11

Polymeric aircraft cabin materials have the potential to produce toxic gases in fires. Lethality (LC50) in animal models is a standard index to rank polymers on the basis of their combustion product toxicity. However, the use of times-to-incapacitation (t sub i s) may be more realistic for predicting relative escape times from a fire environment. Therefore, LC50's and t sub i s for six pure polymers of different chemical classes were determined and compared. The polymers were polyamide, polystyrene, Nylon 6/6, polysulfone, polyethylene, and chlorinated polyethylene. In the study, male Sprague-Dawley rats (150-250 g), 12 animals per fuel loading, were exposed to the pyrolysis products from selected weights of each polymer for 30 min in a 265-L combustion exposure system, and LC50s were determined following a 14-day observation period. GRA

N92-21331# Yale Univ., New Haven, CT.

CONTROL OF BIODEGRADATION IN BACTERIA Final Report, 15 Jul. 1988 - 14 Jul. 1991

L. N. Ornston 26 Aug. 1991 8 p

(Contract DAAL03-88-K-0074)

(AD-A244818; ARO-25493.13-LS) Avail: NTIS HC/MF A02 CSCL 06/5

Analysis of genes for the Beta-ketoadipate pathway revealed mechanisms underlying evolutionary divergence of controls governing biodegradation in bacteria. Transcriptional regulators that respond to muconate in Acinetobacter calcoaceticus and Pseudomonas putida diverged recently from a common ancestor. This divergence produced the A. calcoaceticus catM repressor gene and the P. putida activator catR gene. Thus, a single ancestor gave rise to one gene that exercises negative control and another gene that exerts positive control over transcription. Independently transcribed genes for related physiological functions are clustered in the A calcoaceticus chromosome, and the evolutionary basis for selection of this supraoperonic clustering is unknown. Advances in the genetics of this organism will make it possible to explore the genetic and physiological consequences of engineered transpositions which alter the structure of supraoperonic clusters. GRA

N92-21376*# San Jose State Univ., CA. Dept. of Biological Sciences.

COSMOS 2044. EXPERIMENT K-7-19. PINEAL PHYSIOLOGY IN MICROGRAVITY: RELATION TO RAT GONADAL FUNCTION Final Report

D. Holley, M. R. I. Soliman, I. Krasnov (Institute of Biomedical Problems, Moscow, USSR), and H. Asadi 1989 18 p

(Grant NAG2-594)

(NASA-CR-190066; NAS 1.26:190066) Avail: NTIS HC/MF A03 CSCL 06A

It is now known that the pineal organ can interact with many endocrine and nonendocrine tissues in a regulatory fashion. Given its key role in the regulation of melatonin synthesis, its high concentration, and that its levels may persist longer than the more rapidly changing melatonin, it was felt that serotonin might give a more accurate assessment of the effects of microgravity on pineal

function following recovery of animals from flight. Five-hydroxyindole acetic acid (5-HIAA), a major metabolite of serotonin metabolism, was also measured. One of the most interesting concomitants to spaceflight and exposure to microgravity has been the disturbing alteration in calcium metabolism and resulting skeletal effects. Given the link between exposure to microgravity and perturbation of calcium metabolism and the fact that the pineal is apparently one of the only soft tissues to calcify, pineal calcium content was examined following spaceflight.
Author

N92-21396# Los Alamos National Lab., NM.
ROLES OF REPETITIVE SEQUENCES
G. I. Bell 1991 28 p Presented at the Workshop on Open Problems in Computational Molecular Biology, Telluride, CO, 2-8 Jun. 1991
(Contract W-7405-eng-36)
(DE92-004858; LA-UR-91-4129; CONF-9106319-1) Avail: NTIS HC/MF A03

The DNA of higher eukaryotes contains many repetitive sequences. The study of repetitive sequences is important, not only because many have important biological functions, but also because they provide information on genome organization, evolution and dynamics. In this paper, I will first discuss some generic effects that repetitive sequences will have upon genome dynamics and evolution. In particular, it will be shown that repetitive sequences foster recombination among, and turnover of, the elements of a genome. I will then consider some examples of repetitive sequences, notably minisatellite sequences and telomere sequences as examples of tandem repeats, with and without known function, and Alu sequences as an example of interspersed repeats. Some other examples will also be considered in less detail.
DOE

N92-21718# Office of Naval Research, Arlington, VA.
BIOLOGICAL SCIENCES DIVISION 1991 PROGRAMS Summary Report, 1 Oct. 1990 - 30 Sep. 1991
Eric Eisenstadt Aug. 1991 413 p
(AD-A244800; OCNR-11491-23) Avail: NTIS HC/MF A18 CSCL 07/3

This report documents R and D performed by Principal Investigators under the sponsorship of the ONR Biological Sciences Division during fiscal year 1991. This report includes the following topics: biocatalysis in non aqueous solvents, biodeterioration, biomimetics, biopolymeric materials, education, high temperature, pressure biology, marine symbiosis, marine viruses, molecular biology, marine organisms, water biological interfaces, immunophysiology, cell biology, pressure biology, sensory biophysics, membrane biology I, membrane biology, an single neuron computation.
GRA

N92-21786# Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics.
NON-INVASIVE FUNCTIONAL LOCALIZATION BY BIOMAGNETIC METHODS
J. Nenonen and T. Katila Jan. 1991 54 p
(PB92-134121; TKK-F-A676; ISBN-951-22-0506-8) Avail: NTIS HC/MF A04 CSCL 06A

Noninvasive biomagnetic measurements are feasible for obtaining functional information concerning the electrical activity of various organs, e.g., the human heart and brain. These methods are completely noninvasive, and they have turned out to be promising in localizing various bioelectric sources in the body. During the last years, the number of localization studies reported has increased rapidly. Although the methods are not clinically accepted as yet, possible clinical applications would be numerous; for example, the localization of various cortical sources and epileptic foci in the brain, as well as the localization of arrhythmogenic tissue and both normal and abnormal conduction pathways between the atria and the ventricles in the heart. The best localization accuracies reported in brain studies are of the order of few millimeters, and in heart studies about 1 to 2 cm. These accuracies would be good enough to be useful in presurgical localization of regions of interest, but still more clinical studies are needed to evaluate the efficacy and validity of the methods.
Author

N92-22024* Lockheed Engineering and Sciences Co., Washington, DC.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 32
Lydia Razran Stone, ed. and Joseph Rowe, ed. (Library of Congress, Washington, DC.) Washington NASA Jan. 1992 86 p
(Contract NASw-4292)
(NASA-CR-3922(38); NAS 1.26:3922(38)) Avail: NTIS HC A05 CSCL 06C

This is the thirty-second issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 34 journal or conference papers published in Russian and of 4 Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. The abstracts in this issue have been identified as relevant to 18 areas of space biology and medicine. These areas include: adaptation, aviation medicine, biological rhythms, biospherics, cardiovascular and respiratory systems, developmental biology, exobiology, habitability and environmental effects, human performance, hematology, mathematical models, metabolism, microbiology, musculoskeletal system, neurophysiology, operational medicine, and reproductive system.
Author

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N92-21186# Norwegian Defence Research Establishment, Kjeller. Forsvarets Forskningsinstitutt.
AMINO ACID NEUROTRANSMITTERS; MECHANISMS OF THEIR UPTAKE INTO SYNAPTIC VESICLES
Else Marie Fykse Aug. 1991 61 p
(NDRE/Publ-91/1003; ISSN-0800-4412) Avail: NTIS HC/MF A04

It was shown that gamma-aminobutyric acid (GABA) and L-glutamate (later termed glutamate) were taken up by a Mg(++) and adenosine triphosphate (ATP) dependent mechanism into synaptic vesicles isolated in the rat brain. The vesicular uptake differed clearly from the synaptosomal and glial cell uptake, both with respect to Na(+), Mg(++), and ATP dependency. The uptake of glutamate and GABA was inhibited by similar, but not identical concentrations of different ionophores and by inhibitors of the Mg(++)-ATPase. The uptake of glutamate was dependent on the presence of low concentrations of Cl(-) or Br(-) in the incubation medium, whereas the uptake of GABA was not. In addition, the uptake of glutamate was more potently inhibited by blockers of Cl(-) exchange than the uptake of GABA. The results indicate involvement of a Cl(-) exchanger in the uptake of glutamate. The regional distribution in the brain of the uptake of GABA and glutamate was found to be different. The substrate specificity of the uptake of GABA and glycine was similar, and the vesicular uptake of GABA and glycine was competitively inhibited by different structure analogues. The results support the concept that synaptic vesicles are important for storage of amino acids in the nerve terminal. The mechanisms of the uptake of glutamate and GABA are different, whereas the mechanisms of the uptake of GABA and glycine seems to be similar.
Author

N92-21329# Wisconsin Univ., Madison.
EFFECTS OF HIGH ALTITUDE HYPOXIA ON LUNG AND CHEST WALL FUNCTION DURING EXERCISE Final Report, 30 Jun. 1988 - 29 Sep. 1991
Jerome A. Dempsey 15 Nov. 1991 15 p
(Contract DAMD17-88-C-8053; DA Proj. 3M1-62787-A-879)
(AD-A244627) Avail: NTIS HC/MF A03 CSCL 06/5

We have defined, more precisely than has been done before, the mechanical limits of the lung and chest wall for the ventilatory requirements of exercise in healthy persons. In most instances in

the normal or moderately fit individual, the ventilatory requirement is such that mechanical limitations are barely reached upon expiration, the inspiratory muscles achieve only 40-60 percent of their capacity for pressure generation, and fatigue of the respiratory muscle is not a factor (at least during short term maximum exercise). The greater the maximal VO2, the greater the ventilatory cost and the closer one comes to mechanical limitation of ventilation. Under these conditions, oxygen cost of breathing can approach 13-15 percent of the total VO2 and during long term exercise the diaphragm becomes fatigued. If hypoxia accompanies the exercise, the ventilatory requirement would increase substantially, diaphragm fatigue occurs earlier, mechanical limitations to expiratory flow and inspiratory pressure development occur at lower work-rates, and the diaphragm becomes fatigued in a much shorter exercise time. These factors may contribute significantly to the limitation of exercise performance-especially endurance exercise. GRA

N92-21359# Norwegian Defence Research Establishment, Kjeller.

THE TOXIC EFFECT OF SOMAN ON THE RESPIRATORY SYSTEM

Pal Aas, Frode Fonnum, Rolf Gaustad, and Per Walday 1 Mar. 1991 95 p

(NDRE/Publ-91/1001; ISSN-0800-4412) Avail: NTIS HC/MF A05

The in vitro exposure of rat and guinea pig bronchial smooth muscle to the cholinesterase inhibitor soman (0-(1,2,2-trimethylpropyl) methylphosphonofluoridate), in concentrations from 10 nM - 1 micro-M, potentiated the rapid and concentration-dependent increase in the response to acetylcholine (ACh). The soman concentration of 10 nM corresponded to a 65 and 80-100 percent inhibition of acetylcholinesterase (AChE) in rat and guinea pig bronchi, respectively. The apparent affinity to ACh increased without any change in intrinsic activity in this concentration range. In contrast, soman did not alter the apparent affinity or intrinsic activity of carbachol, which supports the suggestion that the effect of soman is entirely due to its anticholinesterase activity. Soman by itself induced contractions which began at 1-10 nM in rat bronchi and at 0.1-1 nM in guinea pig bronchi. This may be explained by its anticholinesterase activity and the subsequent increase in the synaptic concentration of spontaneously released ACh. In guinea pig bronchi, soman had no effect on histamine-induced contractions, indicating no interaction between the cholinergic nervous system and histamine in this tissue. The effect of soman on inhibition of pseudocholinesterase and carboxylesterases (CarbE) was also examined. The results demonstrated that low concentrations of soman induce contractions of the airway smooth muscle and that guinea pig bronchi are more sensitive to soman than bronchi from rat. Author

N92-21378# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

INDIVIDUAL VARIABILITY OF TISSUE TEMPERATURE PROFILE IN THE HUMAN FOREARM DURING WATER IMMERSION

Michel B. Ducharme Jan. 1991 28 p

(DCIEM-91-10; CTN-92-60408) Avail: NTIS HC/MF A03

The purpose of the present study was to investigate the effect of a range of water temperatures (15 to 36 C) on the shape of the tissue temperature profile of the resting human forearm at thermal stability. Tissue temperature was continuously monitored by a calibrated multicouple probe during 3 hours immersion of the forearm. The probe was implanted approximately 9 cm distal from the olecranon process along the ulnar ridge. Tissue temperature was measured every 5 mm, from the longitudinal axis of the forearm (determined from computed tomography scanning) to the skin surface. For all temperature conditions, the temperature profile inside the limb was linear as a function of the radial distance from the forearm axis when the temperature data were averaged for the different groups at each water temperature tested. However, interindividual variability regarding the shape of the temperature profile was observed, in addition to intraindividual variability in 5 of the 15 subjects. A linear profile was observed in 50 percent of the subjects, a profile with convex curvature in 30 percent and a profile with concave curvature in the remaining 20 percent. No significant relationship was observed between the occurrence rate of the different shapes of temperature profile and the water temperature. These data suggest that anatomical structures like bone and artery located at proximity to the pathway of the thermal probe implantation could have influenced the shape of the individual temperature profile inside the forearm. Author (CISTI)

N92-21493# Tell (Richard) Associates, Inc., Las Vegas, NV.

INDUCED BODY CURRENTS AND HOT AM TOWER CLIMBING: ASSESSING HUMAN EXPOSURE IN RELATION TO THE ANSI RADIOFREQUENCY PROTECTION GUIDE

R. A. Tell 7 Oct. 1991 89 p Sponsored by Federal Communications Commission, Washington, DC

(PB92-125186; FCC/OET/RTA-91-01) Avail: NTIS HC/MF A05 CSCL 06R

The results of the study of the radiofrequency (RF) currents induced in two individuals who climb energized AM broadcast towers for such purposes as tower maintenance are documented. In the study, data on induced currents were obtained using two different AM towers with electrical heights of 0.23 and 0.53 wavelengths. A theoretical analysis of the electric fields near the towers showed that induced body current could be correlated with the radial component of the electric field. These results were consistent with those of an earlier study performed by the Federal Communications Commission and the Environmental Protection Agency. Based on the study, a number of conclusions were reached relative to the question of RF absorption on live AM towers. Author

N92-21714* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 357)

Jan. 1992 69 p

(NASA-SP-7011(357); NAS 1.21:7011(357)) Avail: NTIS HC A04: NTIS standing order as PB91-912300, A03 CSCL 06E

This bibliography lists 186 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Dec. 1991. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

N92-21715* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 359)

Feb. 1992 60 p

(NASA-SP-7011(359); NAS 1.21:7011(359)) Avail: NTIS HC A04: NTIS standing order as PB92-912300, A03 CSCL 06E

This bibliography lists 164 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Jan. 1992. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

N92-22026* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY (SUPPLEMENT 358)

Jan. 1992 229 p

(NASA-SP-7011(358); NAS 1.21:7011(358)) Avail: NTIS HC A11; NTIS standing order as PB92-912300, A03 CSCL 06E

This publication is a cumulative index to the abstracts contained in Supplements 346 through 357 of Aerospace Medicine and

Biology: A Continuing Bibliography. It includes seven indexes: subject, personal author, corporate source, foreign technology, contract number, report number and accession number. Author

N92-22030*# MCAT Inst., San Jose, CA.
INCOMPRESSIBLE VISCOUS FLOW COMPUTATIONS FOR THE PUMP COMPONENTS AND THE ARTIFICIAL HEART Final Report
Cetin Kiris Mar. 1992 36 p Original contains color illustrations
(Contract NCC2-500)
(NASA-CR-190258; MCAT-FR-92-003) Avail: NTIS HC/MF A03; 1 functional color page

A finite-difference, three-dimensional incompressible Navier-Stokes formulation to calculate the flow through turbopump components is utilized. The solution method is based on the pseudocompressibility approach and uses an implicit-upwind differencing scheme together with the Gauss-Seidel line relaxation method. Both steady and unsteady flow calculations can be performed using the current algorithm. In this work, the equations are solved in steadily rotating reference frames by using the steady-state formulation in order to simulate the flow through a turbopump inducer. Eddy viscosity is computed by using an algebraic mixing-length turbulence model. Numerical results are compared with experimental measurements and a good agreement is found between the two. Included in the appendix is a paper on incompressible viscous flow through artificial heart devices with moving boundaries. Time-accurate calculations, such as impeller and diffusor interaction, will be reported in future work. Author

N92-21274*# Houston Baptist Univ., TX. Dept. of Biology.
THE APPLICABILITY OF NONLINEAR SYSTEMS DYNAMICS CHAOS MEASURES TO CARDIOVASCULAR PHYSIOLOGY VARIABLES Final Report
John C. Hooker *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 7 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 06P

N92-21276*# Kansas State Univ., Manhattan. Dept. of Kinesiology.
RESOLVING SENSORY CONFLICT: THE EFFECT OF MUSCLE VIBRATION ON POSTURAL STABILITY Final Report
Charles S. Layne *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 14 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 06P

N92-21307*# Saint Louis Univ., MO. School of Nursing.
EVALUATION OF CUTANEOUS BLOOD FLOW DURING LOWER BODY NEGATIVE PRESSURE TO PREVENT ORTHOSTATIC INTOLERANCE OF BEDREST Final Report
Marilyn Rubin *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 9 p
(For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 06P

N92-21312*# Philadelphia Coll. of Pharmacy and Science, PA. Dept. of Pharmacy Practice.
NONINVASIVE pH-TELEMETRIC MEASUREMENT OF GASTROINTESTINAL FUNCTION Final Report
Karen J. Tietze *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 21 p
(For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 06P

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N92-21322# Lawrence Livermore National Lab., CA.
FURTHER OBSERVATIONS REGARDING CREW PERFORMANCE DETAILS ON COMBAT EFFECTIVENESS
R. S. Hager May 1991 11 p
(Contract W-7405-eng-48)
(DE92-007270; UCRL-ID-108479) Avail: NTIS HC/MF A03

Previous work investigating the impact of differences in crew performance on battle simulation results has been reexamined using recently corrected Crew III performance data. For the scenario under investigation, it was determined that the previously reported 7 percent difference in average performance of a blue force operating with TOW performance and such a force operating with tank performance has increased to 15 percent with the new data. Furthermore, the performance difference is due primariiy to the difference in vehicle shielding which is included as an integral part of the Crew III performance model. (The 15 percent decreases to 1 percent when the Crew III performance is adjusted for average vehicle shielding.) The results of the work reported here indicate that Crew III performance reflects individual performance except in low dose regions where the Crew III model accounts for the probability that degrading symptoms are not occurring to each crewmember. In this case, the overall performance level of each crewmember (and thus also the performance of the crew) increases above the usual representation of individual performance. DOE

N92-21383# Delaware Univ., Newark. Center for Composite Materials.
CONCURRENT ENGINEERING FOR COMPOSITES Final Report
Dick J. Wilkins, Vistasp M. Karbhari, and John M. Henshaw Oct. 1991 184 p
(Contract DAAL03-91-G-0004)
(AD-A244714; ARO-28409.1-MS) Avail: NTIS HC/MF A09 CSCL 11/4

The Total Quality Design (TQD) approach serves as a facilitation tool for the coupled decision making that is necessary for composites. The approach serves as a means of enabling the concurrent engineering of composites through the use of a composites design methodology, as well as the Composites Manufacturing and Design Guide (CMDG). This serves as a decision support system, enabling the design team to not only obtain pertinent information in the shortest possible time, but also serves through its discrimination stacks as a means of rejecting concepts that are not feasible with the customers needs and wants. This serves to reduce conflict. Actual case studies are described, and the methodology is further coupled with the TAGUCHI method, to enable efficient quality control in the RTM process. The methodology is structured so as to enable the design team to conquer barriers of communication, and work in an efficient manner for the successful realization of the design cycle. The approach and tools present a concurrent engineering approach to the application of the latest decision making management techniques to the product realization process for composites. GRA

N92-21384# New York Univ., New York. Center for Neural Science.
HIGH ORDER MECHANISM OF COLOR VISION Final Report, 15 Jun. 1990 - 14 Jun. 1991
John Krauskopf 15 Nov. 1991 54 p
(Grant AF-AFOSR-0429-89)
(AD-A244720; AFOSR-91-1007TR) Avail: NTIS HC/MF A04 CSCL 06/4

This report covers our activities since June 15, 1990. The main accomplishments have been: (1) Continued experiments on the variation of color discrimination over color space; (2) Experiments on the influence of color on the perception of coherent motion; (3) Experiments on the effects of chromatic adaptation on color appearance; (4) Electro-physiological experiments on the effects

of chromatic stimuli on the responses of neurons physiological experiments on the effects of chromatic stimuli on the responses of neurons in the LGN and the visual cortex of macaque; and (5) The development of a new system for making displays for visual experiments on TV monitors which allows at least 12 bits of accuracy in the specification of the intensity of each of the three primaries. GRA

N92-21467*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
VISUALLY GUIDED CONTROL OF MOVEMENT
Walter W. Johnson, ed. and Mary K. Kaiser, ed. Apr. 1991 236 p Workshop held at Moffett Field, CA, 26 Jun. - 14 Jul. 1989
(NASA-CP-3118; A-90200; NAS 1.55:3118) Avail: NTIS HC/MF A11 CSCL 05I

The papers given at an intensive, three-week workshop on visually guided control of movement are presented. The participants were researchers from academia, industry, and government, with backgrounds in visual perception, control theory, and rotorcraft operations. The papers included invited lectures and preliminary reports of research initiated during the workshop. Three major topics are addressed: extraction of environmental structure from motion; perception and control of self motion; and spatial orientation. Each topic is considered from both theoretical and applied perspectives. Implications for control and display are suggested. For individual titles, see N92-21468 through N92-21484.

N92-21468*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE USE OF VISUAL CUES FOR VEHICLE CONTROL AND NAVIGATION
Sandra G. Hart and Vernol Battiste *In its* Visually Guided Control of Movement Apr. 1991 p 7-23 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

At least three levels of control are required to operate most vehicles: (1) inner-loop control to counteract the momentary effects of disturbances on vehicle position; (2) intermittent maneuvers to avoid obstacles, and (3) outer-loop control to maintain a planned route. Operators monitor dynamic optical relationships in their immediate surroundings to estimate momentary changes in forward, lateral, and vertical position, rates of change in speed and direction of motion, and distance from obstacles. The process of searching the external scene to find landmarks (for navigation) is intermittent and deliberate, while monitoring and responding to subtle changes in the visual scene (for vehicle control) is relatively continuous and 'automatic'. However, since operators may perform both tasks simultaneously, the dynamic optical cues available for a vehicle control task may be determined by the operator's direction of gaze for wayfinding. An attempt to relate the visual processes involved in vehicle control and wayfinding is presented. The frames of reference and information used by different operators (e.g., automobile drivers, airline pilots, and helicopter pilots) are reviewed with particular emphasis on the special problems encountered by helicopter pilots flying nap of the earth (NOE). The goal of this overview is to describe the context within which different vehicle control tasks are performed and to suggest ways in which the use of visual cues for geographical orientation might influence visually guided control activities. D.R.D.

N92-21469*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE DISPLAY OF SPATIAL INFORMATION AND VISUALLY GUIDED BEHAVIOR
C. Thomas Bennett *In its* Visually Guided Control of Movement Apr. 1991 p 25-3 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

The basic informational elements of spatial orientation are attitude and position within a coordinate system. The problem that faces aeronautical designers is that a pilot must deal with several coordinate systems, sometimes simultaneously. The display must depict unambiguously not only position and attitude, but also designate the relevant coordinate system. If this is not done accurately, spatial disorientation can occur. The different coordinate systems used in aeronautical tasks and the problems that occur in the display of spatial information are explained. D.R.D.

N92-21470*# Vanderbilt Univ., Nashville, TN. Dept. of Psychology.
PERCEIVING ENVIRONMENTAL STRUCTURE FROM OPTICAL MOTION
Joseph S. Lappin *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 39-61 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Generally speaking, one of the most important sources of optical information about environmental structure is known to be the deforming optical patterns produced by the movements of the observer (pilot) or environmental objects. As an observer moves through a rigid environment, the projected optical patterns of environmental objects are systematically transformed according to their orientations and positions in 3D space relative to those of the observer. The detailed characteristics of these deforming optical patterns carry information about the 3D structure of the objects and about their locations and orientations relative to those of the observer. The specific geometrical properties of moving images that may constitute visually detected information about the shapes and locations of environmental objects is examined. D.R.D.

N92-21471*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE PERCEPTION OF SURFACE LAYOUT DURING LOW LEVEL FLIGHT
John A. Perrone (Stanford Univ., CA.) *In its* Visually Guided Control of Movement Apr. 1991 p 63-7 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Although it is fairly well established that information about surface layout can be gained from motion cues, it is not so clear as to what information humans can use and what specific information they should be provided. Theoretical analyses tell us that the information is in the stimulus. It will take more experiments to verify that this information can be used by humans to extract surface layout from the 2D velocity flow field. The visual motion factors that can affect the pilot's ability to control an aircraft and to infer the layout of the terrain ahead are discussed. D.R.D.

N92-21472*# Cornell Univ., Ithaca, NY. Dept. of Psychology.
OPTICAL FLOW VERSUS RETINAL FLOW AS SOURCES OF INFORMATION FOR FLIGHT GUIDANCE
James E. Cutting *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 75-86 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

The appropriate description is considered of visual information for flight guidance, optical flow vs. retinal flow. Most descriptions in the psychological literature are based on the optical flow. However, human eyes move and this movement complicates the issues at stake, particularly when movement of the observer is involved. The question addressed is whether an observer, whose eyes register only retinal flow, use information in optical flow. It is suggested that the observer cannot and does not reconstruct the image in optical flow; instead they use retinal flow. Retinal array is defined as the projections of a three space onto a point and beyond to a movable, nearly hemispheric sensing device, like the retina. Optical array is defined as the projection of a three space environment to a point within that space. And flow is defined as global motion as a field of vectors, best placed on a spherical projection surface. Specifically, flow is the mapping of the field of changes in position of corresponding points on objects in three space onto a point, where that point has moved in position.
Author

N92-21473*# Canterbury Univ., Christchurch (New Zealand). Dept. of Psychology.
PERCEPTION AND CONTROL OF ROTORCRAFT FLIGHT
Dean H. Owen *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 87-97 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Three topics which can be applied to rotorcraft flight are examined: (1) the nature of visual information; (2) what visual information is informative about; and (3) the control of visual information. The anchorage of visual perception is defined as the distribution of structure in the surrounding optical array or the distribution of optical structure over the retinal surface. A debate was provoked about whether the referent of visual event perception, and in turn control, is optical motion, kinetics, or dynamics. The interface of control theory and visual perception is also considered. The relationships among these problems is the basis of this article. Author

N92-21474*# California Univ., Riverside. Dept. of Psychology.
AN INFORMAL ANALYSIS OF FLIGHT CONTROL TASKS
George J. Andersen *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 99-102 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Issues important in rotorcraft flight control are discussed. A perceptual description is suggested of what is believed to be the major issues in flight control. When the task is considered of a pilot controlling a helicopter in flight, the task is decomposed in several subtasks. These subtasks include: (1) the control of altitude, (2) the control of speed, (3) the control of heading, (4) the control of orientation, (5) the control of flight over obstacles, and (6) the control of flight to specified positions in the world. The first four subtasks can be considered to be primary control tasks as they are not dependent on any other subtasks. However, the latter two subtasks can be considered hierarchical tasks as they are dependent on other subtasks. For example, the task of flight control over obstacles can be decomposed as a task requiring the control of speed, altitude, and heading. Thus, incorrect control of altitude should result in poor control of flight over an obstacle. Author

N92-21475*# Logicon Technical Services, Inc., Dayton, OH.
SENSITIVITY TO EDGE AND FLOW RATE IN THE CONTROL OF SPEED AND ALTITUDE
Lawrence Wolpert *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 103-106 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

A number of studies have examined the potential efficacy of global flow rate and edge rate for specifying changes in self-motion. These have ranged from passive judgements of simulated accelerating self-motion to the active control of altitude in the presence of changes in flow and edge rates. A number of these studies are summarized and an attempt is made to reconcile their respective findings. Author

N92-21476*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MODELING THE PILOT IN VISUALLY CONTROLLED FLIGHT
Walter W. Johnson and Anil V. Phatak (Analytical Mechanics Associates, Inc., Sunnyvale, CA.) *In its* Visually Guided Control of Movement Apr. 1991 p 107-113 Previously announced in IAA as A91-14859 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

The simplest model for a human operator is a gain with a time delay. However, there have been no comprehensive studies evaluating human control strategies in visually controlled flight. The results of preliminary studies on this topic are described. Human visually guided flight control is important both in low level flight, where it predominates, and in higher altitude flights, where instrument failure is always a potential danger. Two general approaches to this problem, one founded on high order perceptual psychophysics and the other on control systems engineering, are described. Initial results show that the use of control engineering modeling techniques, together with a psychophysical analysis of information in the perspective scene, holds promise for capturing the manual control strategies used during visual flight. Author

N92-21477*# California Univ., Davis. Dept. of Mechanical, Aeronautical, and Materials Engineering.
SIMPLE CONTROL-THEORETIC MODELS OF HUMAN STEERING ACTIVITY IN VISUALLY GUIDED VEHICLE CONTROL
Ronald A. Hess *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 115-120 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

A simple control theoretic model of human steering or control activity in the lateral-directional control of vehicles such as automobiles and rotorcraft is discussed. The term 'control theoretic' is used to emphasize the fact that the model is derived from a consideration of well-known control system design principles as opposed to psychological theories regarding egomotion, etc. The model is employed to emphasize the 'closed-loop' nature of tasks involving the visually guided control of vehicles upon, or in close proximity to, the earth and to hypothesize how changes in vehicle dynamics can significantly alter the nature of the visual cues which a human might use in such tasks. Author

N92-21478*# Wright State Univ., Dayton, OH. Dept. of Psychology.
CONTROL WITH AN EYE FOR PERCEPTION: PRECURSORS TO AN ACTIVE PSYCHOPHYSICS
John M. Flach *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 121-149 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

The perception-action cycle is viewed within the context of research in manual control. A portrait of a perception-action system is derived from the primitives of control theory in order to evaluate the promise of this perspective of what Warren and McMillan (1984) have termed 'active psychophysics'. That is, a study of human performance that does justice to the intimate coupling between perception and action. Author

N92-21479*# Virginia Univ., Charlottesville. Dept. of Psychology.
CONTEXTUAL SPECIFICITY IN PERCEPTION AND ACTION
Dennis R. Proffitt *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 151-155 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

The visually guided control of helicopter flight is a human achievement, and, thus, understanding this skill is, in part, a psychological problem. The abilities of skilled pilots are impressive, and yet it is of concern that pilots' performance is less than ideal: they suffer from workload constraints, make occasional errors, and are subject to such debilities as simulator sickness. Remedying such deficiencies is both an engineering and a psychological problem. When studying the psychological aspects of this problem, it is desirable to simplify the problem as much as possible, and thereby, sidestep as many intractable psychological issues as possible. Simply stated, we do not want to have to resolve such polemics as the mind-body problem in order to contribute to the design of more effective helicopter systems. On the other hand, the study of human behavior is a psychological endeavor and certain problems cannot be evaded. Four related issues that are of psychological significance in understanding the visually guided control of helicopter flight are discussed. First, a selected discussion of the nature of descriptive levels in analyzing human perception and performance is presented. It is argued that the appropriate level of description for perception is kinematical, and for performance, it is procedural. Second, it is argued that investigations into pilot performance cannot ignore the nature of pilots' phenomenal experience. The conscious control of actions

is not based upon environmental states of affairs, nor upon the optical information that specifies them. Actions are coupled to perceptions. Third, the acquisition of skilled actions in the context of inherent misperceptions is discussed. Such skills may be error prone in some situations, but not in others. Finally, I discuss the contextual relativity of human errors. Each of these four issues relates to a common theme: the control of action is mediated by phenomenal experience, the veracity of which is context specific. Author

N92-21480*# Illinois Univ., Urbana-Champaign. Dept. of Kinesiology.
VISUALLY GUIDED CONTROL OF MOVEMENT IN THE CONTEXT OF MULTIMODAL STIMULATION
Gary E. Riccio *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 157-174 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Flight simulation has been almost exclusively concerned with simulating the motions of the aircraft. Physically distinct subsystems are often combined to simulate the varieties of aircraft motion. Visual display systems simulate the motion of the aircraft relative to remote objects and surfaces (e.g., other aircraft and the terrain). 'Motion platform' simulators recreate aircraft motion relative to the gravitoinertial vector (i.e., correlated rotation and tilt as opposed to the 'coordinated turn' in flight). 'Control loaders' attempt to simulate the resistance of the aerodynamic medium to aircraft motion. However, there are few operational systems that attempt to simulate the motion of the pilot relative to the aircraft and the gravitoinertial vector. The design and use of all simulators is limited by poor understanding of postural control in the aircraft and its effect on the perception and control of flight. Analysis of the perception and control of flight (real or simulated) must consider that: (1) the pilot is not rigidly attached to the aircraft; and (2) the pilot actively monitors and adjusts body orientation and configuration in the aircraft. It is argued that this more complete approach to flight simulation requires that multimodal perception be considered as the rule rather than the exception. Moreover, the necessity of multimodal perception is revealed by emphasizing the complementarity rather than the redundancy among perceptual systems. Finally, an outline is presented for an experiment to be conducted at NASA ARC. The experiment explicitly considers possible consequences of coordination between postural and vehicular control. Author

N92-21481*# Logicon Technical Services, Inc., Dayton, OH.
ILLUSORY SELF MOTION AND SIMULATOR SICKNESS
Lawrence J. Hettinger *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 175-183 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Presented here is a discussion of simulator sickness (with applications to motion sickness and space sickness) based on the notion of senses as perceptual systems, and the sensory conflict theory. Most forms of the sensory conflict theory unnecessarily propose the existence of a neural store. The neural store is thought to consist of a record of previous perceptual experiences against which currently experienced patterns of stimulation are compared. The authors seek to establish that in its most parsimonious form the sensory conflict theory does not require a construct such as the neural store. In its simpler form, the sensory conflict theory complements and extends Gibson's view of the senses as perceptual systems. Author

N92-21482*# York Univ., Toronto (Ontario). Dept. of Psychology.
SPATIAL VISION WITHIN EGOCENTRIC AND EXOCENTRIC FRAMES OF REFERENCE
Ian P. Howard *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 185-203 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

It is remarkable that we are able to perceive a stable visual world and judge the directions, orientations, and movements of visual objects given that images move on the retina, the eyes move in the head, the head moves on the body, and the body moves in space. An understanding of the mechanisms underlying perceptual stability and spatial judgements requires precise definitions of relevant coordinate systems. An egocentric frame of reference is defined with respect to some part of the observer. There are four principal egocentric frames of reference, a station-point frame associated with the nodal point of the eye, an retinocentric frame associated with the retina, a headcentric frame associated with the head, and a bodycentric frame (torsocentric) associated with the torso. Additional egocentric frames can be identified with respect to any segment of the body. An egocentric task is one in which the position, orientation, or motion of an object is judged with respect to an egocentric frame of reference. A proprioceptive is a special kind of egocentric task in which the object being judged is also part of the body. An example of a proprioceptive task is that of directing the gaze toward the seen or unseen toe. An exocentric frame of reference is external to the observer. Geographical coordinates and the direction of gravity are examples of exocentric frames of reference. These various frames are listed in tabular form, together with examples of judgements of each type. Author

N92-21483*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
VISUAL DIRECTION AS A METRIC OF VIRTUAL SPACE
Stephen R. Ellis, Stephen Smith (Sterling Software, Palo Alto, CA.), and Selim Hacisalihzade *In its* Visually Guided Control of Movement Apr. 1991 p 205-212 Previously announced in IAA as A90-31378 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Two experiments examine the abilities of ten subjects to visualize directions shown on a perspective display. Subjects indicated their perceived directions by adjusting a head-mounted cursor to correspond to the direction depicted on the display. This task is required of telerobotic operators who use map-like pictures of their workspace to determine the direction of objects seen by direct view. Results show significant open loop judgment biases that may be composed of errors arising from misinterpretation of the map geometry and overestimation of gaze direction. Author

N92-21484*# Charles River Associates, Inc., Cambridge, MA.
PILOT/VEHICLE MODEL ANALYSIS OF VISUALLY GUIDED FLIGHT
Greg L. Zacharias *In* NASA. Ames Research Center, Visually Guided Control of Movement Apr. 1991 p 213-235 (For primary document see N92-21467 12-53)
Avail: NTIS HC/MF A11 CSCL 05I

Information is given in graphical and outline form on a pilot/vehicle model description, control of altitude with simple terrain clues, simulated flight with visual scene delays, model-based in-cockpit display design, and some thoughts on the role of pilot/vehicle modeling. Author

N92-21506# Palo Alto Coll., CA. Dept. of Aviation Technology.
FORGETTING A TASK: STRATEGIES FOR ENHANCING THE PILOT'S MEMORY Abstract Only
Gary J. Northam *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N92-21209*# Texas Univ., Austin. Mechanical Engineering Design Projects Program.

DESIGN OF INTERNAL SUPPORT STRUCTURES FOR AN INFLATABLE LUNAR HABITAT

Elizabeth A. Cameron, John A. Duston, and David D. Lee 1990 135 p

(Contract NASw-4435)

(NASA-CR-189996; NAS 1.26:189996) Avail: NTIS HC/MF A07 CSCL 06K

NASA has a long range goal of constructing a fully equipped, manned lunar outpost on the near side of the moon by the year 2015. The proposed outpost includes an inflatable lunar habitat to support crews during missions longer that 12 months. A design for the internal support structures of the inflatable habitat is presented. The design solution includes material selection, substructure design, assembly plan development, and concept scale model construction. Alternate designs and design solutions for each component of the design are discussed. Alternate materials include aluminum, titanium, and reinforced polymers. Vertical support alternates include column systems, truss systems, suspension systems, and lunar lander supports. Horizontal alternates include beams, trusses, floor/truss systems, and expandable trusses. Feasibility studies on each alternate showed that truss systems and expandable trusses were the most feasible candidates for conceptual design. The team based the designs on the properties of 7075 T73 aluminum. The substructure assembly plan, minimizes assembly time and allows crews to construct the habitat without the use of EVA suits. In addition to the design solutions, the report gives conclusions and recommendations for further study of the inflatable habitat design. Author

N92-21243*# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.

A LUNAR BASE REFERENCE MISSION FOR THE PHASED IMPLEMENTATION OF BIOREGENERATIVE LIFE SUPPORT SYSTEM COMPONENTS Final Report

Laura N. Dittmer, Michael E. Drews, Sean K. Lineaweaver, Derek E. Shipley, and A. Hoehn 18 Jun. 1991 169 p

(Contract NASw-4435)

(NASA-CR-189973; NAS 1.26:189973) Avail: NTIS HC/MF A08 CSCL 06K

Previous design efforts of a cost effective and reliable regenerative life support system (RLSS) provided the foundation for the characterization of organisms or 'biological processors' in engineering terms and a methodology was developed for their integration into an engineered ecological LSS in order to minimize the mass flow imbalances between consumers and producers. These techniques for the design and the evaluation of bioregenerative LSS have now been integrated into a lunar base reference mission, emphasizing the phased implementation of components of such a BLSS. In parallel, a designers handbook was compiled from knowledge and experience gained during past design projects to aid in the design and planning of future space missions requiring advanced RLSS technologies. The lunar base reference mission addresses in particular the phased implementation and integration of BLS parts and includes the resulting infrastructure burdens and needs such as mass, power, volume, and structural requirements of the LSS. Also, operational aspects such as manpower requirements and the possible need and application of 'robotics' were addressed. Author

N92-21246*# Kansas State Univ., Manhattan. Dept. of Mechanical Engineering.

AUTOMATION OF CLOSED ENVIRONMENTS IN SPACE FOR HUMAN COMFORT AND SAFETY Report, for Academic Year 1990-1991

25 Nov. 1991 156 p

(Contract NASw-4435)

(NASA-CR-190016; NAS 1.26:190016) Avail: NTIS HC/MF A08 CSCL 06K

The results of the second year of a three year design project on the automation of the Environmental Control and Life Support System (ECLSS) of the Space Station Freedom (SSF) are presented. The results are applicable to other space missions that require long duration space habitats. A description of conceptual controls which are developed for the Water Recovery and Management (WRM) Subassembly is given. Mathematical modeling of the Air Revitalization (AR) Subassembly is presented. The work done by the Kansas State University NASA/USRA interdisciplinary student design team is concluded with a discussion of the expert system which was developed for the AR Subassembly. Author

N92-21345*# Southwest Research Inst., San Antonio, TX.

INVESTIGATION OF POSSIBLE CAUSES FOR HUMAN-PERFORMANCE DEGRADATION DURING MICROGRAVITY FLIGHT Final Report, 17 Jan. - 30 Nov. 1991

James E. Schroeder and Megan L. Tuttle 26 Mar. 1992 223 p Original contains color illustrations

(Grant NAG9-487; SwRI Proj. 12-4075)

(NASA-CR-190114; NAS 1.26:190114) Avail: NTIS HC/MF A10; 1 functional color page CSCL 05H

The results of the first year of a three year study of the effects of microgravity on human performance are given. Test results show support for the hypothesis that the effects of microgravity can be studied indirectly on Earth by measuring performance in an altered gravitational field. The hypothesis was that an altered gravitational field could disrupt performance on previously automated behaviors if gravity was a critical part of the stimulus complex controlling those behaviors. In addition, it was proposed that performance on secondary cognitive tasks would also degrade, especially if the subject was provided feedback about degradation on the previously automated task. In the initial experimental test of these hypotheses, there was little statistical support. However, when subjects were categorized as high or low in automated behavior, results for the former group supported the hypotheses. The predicted interaction between body orientation and level of workload in their joint effect on performance in the secondary cognitive task was significant for the group high in automatized behavior and receiving feedback, but no such interventions were found for the group high in automatized behavior but not receiving feedback, or the group low in automatized behavior. Author

N92-21549*# Center for NeuroDiagnostic Study, Inc., San Jose, CA.

ELECTROENCEPHALOGRAPHIC MONITORING OF COMPLEX MENTAL TASKS Final Report

Raul Guisado, Richard Montgomery, Leslie Montgomery, and Chris Hickey Washington Langley Research Center Feb. 1992 284 p

(Contract NAS1-18847)

(NASA-CR-4425; NAS 1.26:4425) Avail: NTIS HC/MF A13 CSCL 05H

Outlined here is the development of neurophysiological procedures to monitor operators during the performance of cognitive tasks. Our approach included the use of electroencepalographic (EEG) and rheoencephalographic (REG) techniques to determine changes in cortical function associated with cognition in the operator's state. A two channel tetrapolar REG, a single channel forearm impedance plethysmograph, a Lead I electrocardiogram (ECG) and a 21 channel EEG were used to measure subject responses to various visual-motor cognitive tasks. Testing, analytical, and display procedures for EEG and REG

monitoring were developed that extend the state of the art and provide a valuable tool for the study of cerebral circulatory and neural activity during cognition. Author

N92-21554# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: SCIENTIFIC AND TECHNICAL TERMS
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613573; INIS-MF-13049) Avail: NTIS HC/MF A01
This fact sheet explains the scientific and technical terms used in describing food irradiation processes. DOE

N92-21555# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: FOOD IRRADIATION AND RADIOACTIVITY
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Agency, Vienna, Austria
(DE92-613574; INIS-MF-13050) Avail: NTIS HC/MF A01
This fact sheet addresses the issue of whether food irradiation makes food radioactive and explains the difference between 'irradiation food' and 'radioactive food'. DOE

N92-21556# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: CHEMICAL CHANGES IN IRRADIATED FOODS
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613575; INIS-MF-13051) Avail: NTIS HC/MF A01
This fact sheet addresses the safety of irradiated food. The irradiation process produces very little chemical change in food, and laboratory experiments have shown no harmful effects in animals fed with irradiated milk powder. DOE

N92-21557# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: NUTRITIONAL QUALITY OF IRRADIATED FOODS
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613576; INIS-MF-13052) Avail: NTIS HC/MF A01
This fact sheet briefly considers the nutritional value of irradiated foods. Micronutrients, especially vitamins, are sensitive to any food processing method, but irradiation does not cause any special nutritional problems in food. DOE

N92-21558# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: GENETIC STUDIES
May 1991 4 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613577; INIS-MF-13053) Avail: NTIS HC/MF A01
Results published in the mid-1970s from the National Institute of Nutrition (NIN) in India showed increased numbers of polyploid cells in rats, mice, monkeys and malnourished children fed irradiated wheat products. This fact sheet considers the validity of these results. A large number of independent studies have been subsequently performed, and in none of these have results been obtained that support the NIN findings. The conclusion is that there is no evidence to link the consumption of irradiated food with any mutagenic effect. DOE

N92-21559# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: MICROBIOLOGICAL SAFETY OF IRRADIATED FOOD
May 1991 4 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613578; INIS-MF-13054) Avail: NTIS HC/MF A01
This fact sheet considers the microbiological safety of irradiated food, with especial reference to Clostridium botulinum. Irradiated food, as food treated by any 'sub-sterilizing' process, must be handled, packaged and stored following good manufacturing practices to prevent growth and toxin production of C. botulinum. Food irradiation does not lead to increased microbiological hazards, nor can it be used to save already spoiled foods. DOE

N92-21560# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: IRRADIATION AND FOOD SAFETY
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613579; INIS-MF-13055) Avail: NTIS HC/MF A01
This fact sheet focusses on the question of whether irradiation can be used to make spoiled food good. No food processing procedures can substitute for good hygienic practices, and good manufacturing practices must be followed in the preparation of food whether or not the food is intended for further processing by irradiation or any other means. DOE

N92-21561# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: IRRADIATION AND FOOD ADDITIVES AND RESIDUES
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613580; INIS-MF-13056) Avail: NTIS HC/MF A01
This fact sheet considers the issue of the irradiation of food containing food additives or pesticide residues. The conclusion is that there is no health hazard posed by radiolytic products of pesticides or food additives. DOE

N92-21562# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: PACKAGING OF IRRADIATED FOODS
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613581; INIS-MF-13057) Avail: NTIS HC/MF A01
This fact sheet considers the effects on packaging materials of food irradiation. Extensive research has shown that almost all commonly used food packaging materials toted are suitable for use. Furthermore, many packaging materials are themselves routinely sterilized by irradiation before being used. DOE

N92-21563# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: FOOD IRRADIATION COSTS
May 1991 2 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613582; INIS-MF-13060) Avail: NTIS HC/MF A01
This fact sheet gives the cost of a typical food irradiation facility (US $1 to $3 million) and of the food irradiation process (US $10 to 15 per ton for low dose applications; US $100 to 250 per ton for high dose applications). These treatments also bring consumer benefits in terms of availability, storage life and improved hygiene. DOE

N92-21564# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: IRRADIATED FOODS AND THE CONSUMER

May 1991 4 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613583; INIS-MF-13061) Avail: NTIS HC/MF A01

This fact sheet discusses market testing of irradiate food, consumer response to irradiated products has always been positive, and in some countries commercial quantities of some irradiated food items have been sold on a regular basis. Consumers have shown no reluctance to buy irradiated food products. DOE

N92-21589* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
LUNAR RADIATOR SHADE Patent
Michael K. Ewert, inventor (to NASA) 11 Feb. 1992 5 p Filed 25 Sep. 1991 Supersedes N92-11639 (30 - 2, p 292)
(NASA-Case-MSC-21868-1; US-Patent-5,086,828; US-Patent-Appl-SN-765273; US-Patent-Class-165-1; US-Patent-Class-165-41; US-Patent-Class-165-86; US-Patent-Class-165-904; US-Patent-Class-165-48.2; US-Patent-Class-136-245; US-Patent-Class-136-246) Avail: US Patent and Trademark Office CSCL 06K

An apparatus for rejecting waste heat from a system located on or near the lunar equator is presented. The system utilizes a reflective catenary shaped trough deployed about a vertical radiator to shade the radiator from heat emitted by the hot lunar surface. The catenary shaped trough is constructed from a film material and is aligned relative to the sun so that incoming solar energy is focused to a line just above the vertical radiator and can thereby isolate the radiator from the effects of direct sunlight. The film is in a collapsed position between side by side support rods, all of which are in a transport case. To deploy the film and support rods, a set of parallel tracks running perpendicular to length of the support rods are extended out from the transport case. After the support tracks are deployed, the support rods are positioned equidistant from each other along the length of the support tracks so that the flexible film shade between adjacent support rods is unfolded and hangs in a catenary shaped trough. A heat radiator is supported between each pair of support rods above each hanging reflective trough.
Official Gazette of the U.S. Patent and Trademark Office

N92-21590# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: SAFETY OF IRRADIATION FACILITIES
May 1991 4 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-613601; INIS-MF-13058) Avail: NTIS HC/MF A01

This fact sheet considers the safety of industrial irradiation facilities. Although there have been accidents, none of them has endangered public health or environmental safety, and the radiation processing industry is considered to have a very good safety record. Gamma irradiators do not produce radioactive waste, and the radiation sources at the facilities cannot explode nor in any other way release radioactivity into the environment. DOE

N92-21591# Food and Agriculture Organization of the United Nations, Rome (Italy).
FACTS ABOUT FOOD IRRADIATION: CONTROLLING THE PROCESS
May 1991 4 p Prepared in cooperation with World Health Organization, Geneva, Switzerland; and International Atomic Energy Agency, Vienna, Austria
(DE92-614091; INIS-MF-13059) Avail: NTIS HC/MF A01

This fact sheet briefly reviews the procedures that exist to control the process of food irradiation. It also summarizes the difficulties in identifying irradiated food, which stem from the fact that irradiation does not physically change the food or cause significant chemical changes in foods. DOE

N92-21272*# Mary Hardin-Baylor Univ., Belton, TX. Dept. of Mathematics and Physics.
CLOSED-LOOP HABITATION AIR REVITALIZATION MODEL FOR REGENERATIVE LIFE SUPPORT SYSTEMS Final Report
Maxwell M. Hart *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 05H

N92-21309*# Wisconsin Univ., Milwaukee. Dept. of Health Sciences.
THE DOUBLY LABELED WATER METHOD FOR MEASURING HUMAN ENERGY EXPENDITURE: ADAPTATIONS FOR SPACEFLIGHT Final Report
Leslie O. Schulz *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 7 p
(For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05H

N92-21972# Naval Weapons Center, China Lake, CA.
FIXED WING NIGHT CARRIER AEROMEDICAL CONSIDERATIONS
J. C. Antonio *In* AGARD, Aircraft Ship Operations Nov. 1991 3 p (For primary document see N92-21951 12-05)
Copyright Avail: NTIS HC/MF A15; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N92-21118# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Mecanique.
DIGITAL CONTROL MACHINES FOR COORDINATE MEASUREMENTS [LES MACHINES DE COORDONNEES A COMMANDE NUMERIQUE]
Leo Janssens 1991 9 p In FRENCH
(ETN-92-90943) Avail: NTIS HC/MF A02

The performance of several commercial digital control machines for measuring coordinates is discussed. The characteristics, the tasks to be achieved, and the suitability of a machine to be chosen are considered. The fabrication tendency observed in the construction of these machines is directed towards the decrease of the measurements uncertainties and the increase of the displacement velocity. The software developed for the measuring machines is directed towards the work based on personal computer

systems. The machines for measuring coordinates become fast and accurate. A development towards computer aided design associated with two dimensional software and specific protocols are observed. Man machine dialogue is mainly performed using window type software tools. ESA

N92-21317# McMaster Univ., Hamilton (Ontario). Communications Research Lab.
OPTICAL AND NEURAL COMPUTING ARCHITECTURES Final Report, 1 Oct. 1989 - 30 Sep. 1990
Simon Haykin and Paul Jessop Sep. 1990 61 p Sponsored by Defence Research Establishment
(CTN-92-60427) Avail: NTIS HC/MF A04

In this report the current status of neural network research is reviewed and the role of optical technology in the future development of parallel computing architectures is assessed. Attention is given to applications which relate to the Canadian national defense environment and which are likely to benefit from the new technology. Neural networks are expected to significantly outperform conventional digital computers in the areas of pattern recognition, signal processing, and optimization problems. The development of optical neural computing will require significant advances in the area of optical devices. Optical technologies likely to have a significant impact on optical computing are reviewed. Two different applications of optical neurocomputing with special merits are optical associative memories and fiber optics transmission. Neural networks designed to operate as optical associative memories which can be implemented in present day technology using a combination of optics and electronics, lend themselves to the use of optical techniques. The combination of neural networks and fiber optics offers the potential for developing novel transmission techniques. In addition the use of optical neural networks for radar image reconstruction could be extremely rewarding. Recommendations are made for directions in Canadian research and development efforts in optical and neural computing. CISTI

N92-21320# Laval Univ. (Quebec). Centre d'Optique, Photonique et Laser.
OPTICAL AND NEURAL COMPUTING ARCHITECTURES Final Report, 1 Sep. 1989 - 31 Aug. 1990
Henri H. Arsenault, Yunlong Sheng, Claude Lejeune, and Luc Leclerc 31 Aug. 1990 155 p Sponsored by Defence Research Establishment
(CTN-92-60428) Avail: NTIS HC/MF A08

An evaluation of the present state of the art in neural computers, optical computers and their architectures, and optical neural nets and their architectures is presented. The area surveyed covers analog optical computing, digital optical computing, optical interconnections, optical computing devices and technologies, and optical neural nets. A detailed comparison of the fundamental capabilities of optics and electronics is carried out. The degree to which these capabilities are developed is discussed. This is followed by an overview of the accomplishments of optical computing, and of the proposals that were made to promote the advantages of optics. A detailed discussion of the applications of neural nets describes the many applications of such systems. Optical computing and optical neural net architectures are detailed. Applications of neural nets to defense are presented. Canadian needs in the fields of optical computing and neural nets are discussed. There is potential for massive computing and processing that surpasses present day electronics technologies by orders of magnitude. By and large, this potential is not reached in most cases due to technological limitations. The advent of new devices such as surface emitting micro laser diode array (SELDA) laser arrays and of faster and larger spatial light modulators should allow optical systems to at least match electronic systems. Development of practical systems will probably take at least 10 years. Author (CISTI)

N92-21369# Naval Postgraduate School, Monterey, CA.
A DESIGN OF FLOATING POINT FFT USING GENESIL SILICON COMPILER M.S. Thesis
Chung-Kuei Lu Jun. 1991 75 p
(AD-A245149) Avail: NTIS HC/MF A04 CSCL 12/5

The hardware of floating point MULTIPLY, ADD, and SUBTRACT units are designed to support the multiplication, addition, and subtraction operation necessary in the Fast Fourier Transform (FFT). In this thesis, the IEEE floating point standard is adopted and scaled down to 16 bits, but the exponent is an excess-8 number represented using radix-2. A 16 bit reduced word size floating point arithematic unit for high speed signal analysis was implemented. The layout verification, functional simulation, and timing analysis of these units have been performed on the Genesil Silicon Compiler (GSC) system that was developed to overcome the shortcomings of the time consuming custom layout methods. The design of this thesis work can be used for further investigation of the high speed, pipelined floating-point arithmetic units. GRA

N92-21452# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
RELATIONAL DATA BANK ARCHITECTURE WITH AN ASSOCIATIVE MEMORY Ph.D. Thesis [RELATIONALE DATENBANKARCHITEKTUR MIT ASSOZIATIVSPEICHER]
Peter Rieckhoff 1991 150 p In GERMAN
(ETN-92-91149) Avail: NTIS HC/MF A07

It is shown that the design of a data bank architecture is based on the relational data model. A simple data structure without any determined data type preference is represented for the data bank. The associative access possibility supports the data bank operations. The data bank architecture is composed of two associative memories, the associative attribute memory and the associative character chain memory. A great capacity memory module is necessary for the storage of the general data volume of a data bank in an associative semiconductor memory. The memory cost and realization times can be lowered in comparison with a data bank with semiconductor memory. A long charging time of the data bank is emphasized as a drawback. ESA

N92-21464*# Unisys Corp., Hampton, VA.
AN IMPROVED LATERAL CONTROL WHEEL STEERING LAW FOR THE TRANSPORT SYSTEMS RESEARCH VEHICLE (TSRV)
W. A. Ragsdale Mar. 1992 37 p
(Contract NAS1-19119)
(NASA-CR-189602; NAS 1.26:189602) Avail: NTIS HC/MF A03 CSCL 09B

A lateral control wheel steering law with improved performance was developed for the Transport Systems Research Vehicle (TSRV) simulation and used in the Microwave Landing System research project. The control law converted rotational hand controller inputs into roll rate commands, manipulated ailerons, spoilers, and the rudder to achieve the desired roll rates. The system included automatic turn coordination, track angle hold, and autopilot/autoland modes. The resulting control law produced faster roll rates (15 degrees/sec), quicker response to command reversals, and safer bank angle limits, while using a more concise program code. Author

N92-21598# Helsinki Univ. of Technology, Espoo (Finland). Dept. of Computer Science.
GDM: GLOBAL DISTRIBUTED MEMORY
A. Gustafsson, H. Aronsson, and H. Suonsivu 22 May 1991 23 p
(PB92-134212; TKO-C49; ISBN-951-22-0606-4) Avail: NTIS HC/MF A03 CSCL 09B

Global Distributed Memory (GDM) is a distributed memory system in the spirit of Linda. Its distinctive features are multiple object spaces and efficient 'write in validate' caching of frequently accessed objects. The GDM model is described along with the Trollius based OhtGDM implementation. Author

N92-21830# National Inst. of Standards and Technology, Gaithersburg, MD.
GUIDE TO EXPERT SYSTEM BUILDING TOOLS FOR MICROCOMPUTERS Final Report
C. E. Dabrowski and E. N. Fong Jul. 1991 151 p
(PB92-108893; NIST/SP-500/188) Avail: NTIS HC/MF A08; also available SOD HC $8.50 as 003-003-03088-1 CSCL 09B

Microcomputer-based expert system building tools (ESBTs), sometimes known as expert system shells, are software packages for development of expert systems that run on microcomputers. Here, information is given that provides systems managers, planners, and potential expert system developers with a readable description of ESBTs for microcomputers, including a detailed description of specific tool features and the capabilities that they support. The technical content reported here is based on analysis of commercially available ESBTs. However, commercial products are not described, compared, or ranked. Author

N92-22025*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
INTEGRATING SECURITY IN A GROUP ORIENTED DISTRIBUTED SYSTEM
Michael Reiter, Kenneth Birman, and Li Gong Feb. 1992 17 p Sponsored in part by DARPA, GTE, IBM, Siemens, Inc., NSF, and DOD
(Grant NAG2-593)
(NASA-CR-189933; NAS 1.26:189933; TR-92-1269) Avail: NTIS HC/MF A03 CSCL 09B

A distributed security architecture is proposed for incorporation into group oriented distributed systems, and in particular, into the Isis distributed programming toolkit. The primary goal of the architecture is to make common group oriented abstractions robust in hostile settings, in order to facilitate the construction of high performance distributed applications that can tolerate both component failures and malicious attacks. These abstractions include process groups and causal group multicast. Moreover, a delegation and access control scheme is proposed for use in group oriented systems. The focus is the security architecture; particular cryptosystems and key exchange protocols are not emphasized. Author

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N92-21134# Argonne National Lab., IL. Mathematics and Computer Science Div.
USER GUIDE FOR THE MINPACK-2 TEST PROBLEM COLLECTION
Brett M. Averick (Minnesota Univ., Minneapolis.) and Jorge J. More Oct. 1991 91 p
(Contract W-31-109-eng-38)
(DE92-006796; ANL/MCS-TM-157) Avail: NTIS HC/MF A05

The Army High Performance Computing Research Center at the University of Minnesota and the Mathematics and Computer Science Division at Argonne National Laboratory are collaborating on the development of the software package, MINPACK-2. As part of the MINPACK-2 project, we are developing a collection of significant optimization problems to serve as test problems for the package. This report describes the software associated with the preliminary version of the MINPACK-2 test problem collection. The discussion centers on the description of subroutine parameters, but additional information on the implementation of these subroutines is also provided. The information in this report should be sufficient to use these subroutines for testing and evaluating software. DOE

N92-21135# Argonne National Lab., IL.
PROCEEDINGS OF THE WORKSHOP ON COMPILATION OF (SYMBOLIC) LANGUAGES FOR PARALLEL COMPUTERS
I. Foster, comp. and E. Tick, comp. Nov. 1991 176 p Workshop held in San Diego, 31 Oct. - 1 Nov. 1991
(Contract W-31-109-eng-38)
(DE92-006819; ANL-91/34; CONF-9110321) Avail: NTIS HC/MF A09

This report comprises the abstracts and papers for the talks presented at the Workshop on Compilation of (Symbolic) Languages for Parallel Computers, held Oct. 31 to Nov. 1, 1991, in San Diego. These unreferred contributions were provided by the participants for the purpose of this workshop; many of them will be published elsewhere in peer-reviewed conferences and publications. Our goal in planning this workshop was to bring together researchers from different disciplines with common problems in compilation. In particular, we wished to encourage interaction between researchers working in compilation of symbolic languages and those working on compilation of conventional, imperative languages. The fundamental problems facing researchers interested in compilation of logic, functional, and procedural programming languages for parallel computers are essentially the same. However, differences in the basic programming paradigms have led to different communities emphasizing different species of the parallel compilation problem. For example, parallel logic and functional languages provide dataflow-like formalisms in which control dependencies are unimportant. Hence, a major focus of research in compilation has been on techniques that try to infer when sequential control flow can safely be imposed. Granularity analysis for scheduling is a related problem. The single assignment property leads to a need for analysis of memory use in order to detect opportunities for reuse. Much of the work in each of these areas relies on the use of abstract interpretation techniques. DOE

N92-21136# Lawrence Livermore National Lab., CA.
SLIC: THE INTERACTIVE, GRAPHIC MESH GENERATOR FOR FINITE-ELEMENT AND FINITE DIFFERENCE APPLICATION PROGRAMS
M. A. Gerhard Sep. 1991 233 p
(Contract W-7405-eng-48)
(DE92-006825; UCRL-MA-108429) Avail: NTIS HC/MF A11

This report discusses the following topics on SLIC: getting started; example generation of a 2-d mesh; controls; geometry construction; boundary condition commands; element/node construction commands; sliding interface commands; and displaying the mesh. DOE

N92-21180# National Academy of Sciences - National Research Council, Washington, DC.
MATHEMATICAL FOUNDATIONS OF HIGH-PERFORMANCE COMPUTING AND COMMUNICATIONS
1991 40 p Sponsored by NSF
Avail: NTIS HC/MF A03

The National Research Council's Panel on the Mathematical Sciences in High Performance Computing and Communication (HPCC) examines the elements of the Federal Government's HPCC Program and explicitly identifies the role of the mathematical sciences community in that effort. Furthermore, it identifies the role of mathematical sciences research in an illustrative subset of challenges of computational sciences. Recent contributions of mathematical sciences to HPCC includes hardware and software improvements, and a National Research and Education Network that will increase computer performance and communication by a thousandfold. For future success and development, it is crucial that ongoing research and development continue on hardware, software, networks, and human resources. Among the challenges that need to be met are improvements in computational fluid dynamics, computational biology, dynamics of cardiac models, global changes, material science, geophysical modeling, machine vision, and human-machine communication. Finally, the report notes a number of specific areas where new mathematical sciences

research is needed, including algorithms, dynamic graphics, pattern matching, and nonlinear modeling. H.A.

N92-21189*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
HOW TO SECURELY REPLICATE SERVICES (PRELIMINARY VERSION)
Michael Reiter and Kenneth Birman Mar. 1992 20 p Sponsored in part by GTE; IBM; Siemens, Inc.; and NSF
(Grant NAG2-593)
(NASA-CR-190162; NAS 1.26:190162; CU-TR-92-1274) Avail: NTIS HC/MF A03 CSCL 09B

A method is presented for constructing replicated services that retain their availability and integrity despite several servers and clients being corrupted by an intruder, in addition to others failing benignly. More precisely, a service is replicated by 'n' servers in such a way that a correct client will accept a correct server's response if, for some prespecified parameter, k, at least k servers are correct and fewer than k servers are correct. The issue of maintaining causality among client requests is also addressed. A security breach resulting from an intruder's ability to effect a violation of causality in the sequence of requests processed by the service is illustrated. An approach to counter this problem is proposed that requires that fewer than k servers are corrupt and, to ensure liveness, that k is less than or = n - 2t, where t is the assumed maximum total number of both corruptions and benign failures suffered by servers in any system run. An important and novel feature of these schemes is that the client need not be able to identify or authenticate even a single server. Instead, the client is required only to possess at most two public keys for the service. Author

N92-21224# Lawrence Livermore National Lab., CA.
A PROTOTYPE FUNCTIONAL LANGUAGE IMPLEMENTATION FOR HIERARCHICAL-MEMORY ARCHITECTURES
R. Wolski, J. Feo, and D. Cann 14 Jan. 1992 9 p Presented at the 25th Hawaii International Conference on System Sciences, Kauai, HI, 7-10 Jan. 1992
(Contract W-7405-eng-48)
(DE92-007308; UCRL-JC-107437-Rev-1; CONF-920114-1-Rev-1) Avail: NTIS HC/MF A02

Programming languages are the most important tool at a programmers' disposal. All other tools correct, visualize, or evaluate the product crafted by this tool. The advent of multiprocessor computer systems has greatly complicated the programmer's task and increased his need for high-level languages capable of automatically taming these architectures. We describe a prototype implementation of Sisal for multiprocessor, hierarchical-memory systems. The implementation includes explicit compiler and runtime control that effectively exploits the different levels of memory and manages interprocess communications (IPC). We give preliminary performance results for this system on the BBN TC2000. DOE

N92-21240# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
MINTO: A MIXED INTEGER OPTIMIZER
Martin W. P. Savelsbergh, Gabriel C. Sigismondi, and George L. Nemhauser (Georgia Inst. of Tech., Atlanta.) Aug. 1991 17 p
(Grants NATO-N62-316.89; NSF ISI-87-61183; NATO-CRG-901057)
(Memo-COSOR-91-18; ISSN-0926-4493; ETN-92-91136) Avail: NTIS HC/MF A03

MINTO (Mixed INTeger Optimizer) is a software system that solves mixed integer linear programs by a branch and bound algorithm with linear programming relaxations. It also provides automatic constraint classification, preprocessing, primal heuristics and constraint generation. Moreover, the user can enrich the basic algorithm by providing a variety of specialized applications routines that can customize MINTO to achieve maximum efficiency for a problem class. MINTO is documented by specifying what it is capable of doing and how to use it. ESA

N92-21251*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
EXECUTION MODELS FOR MAPPING PROGRAMS ONTO DISTRIBUTED MEMORY PARALLEL COMPUTERS Final Report
Alan Sussman Mar. 1992 31 p Submitted for publication
(Contracts NAS1-18605; MDA972-90-C-0035; ARPA Order 7330)
(NASA-CR-189613; NAS 1.26:189613; ICASE-92-8) Avail: NTIS HC/MF A03 CSCL 09B

The problem of exploiting the parallelism available in a program to efficiently employ the resources of the target machine is addressed. The problem is discussed in the context of building a mapping compiler for a distributed memory parallel machine. The paper describes using execution models to drive the process of mapping a program in the most efficient way onto a particular machine. Through analysis of the execution models for several mapping techniques for one class of programs, we show that the selection of the best technique for a particular program instance can make a significant difference in performance. On the other hand, the results of benchmarks from an implementation of a mapping compiler show that our execution models are accurate enough to select the best mapping technique for a given program. Author

N92-21341*# Old Dominion Univ., Norfolk, VA. Dept. of Computer Science.
SOFTWARE RELIABILITY REPORT
Larry Wilson 1991 220 p
(Grant NAG1-750)
(NASA-CR-187688; NAS 1.26:187688) Avail: NTIS HC/MF A10 CSCL 09B

There are many software reliability models which try to predict future performance of software based on data generated by the debugging process. Unfortunately, the models appear to be unable to account for the random nature of the data. If the same code is debugged multiple times and one of the models is used to make predictions, intolerable variance is observed in the resulting reliability predictions. It is believed that data replication can remove this variance in lab type situations and that it is less than scientific to talk about validating a software reliability model without considering replication. It is also believed that data replication may prove to be cost effective in the real world, thus the research centered on verification of the need for replication and on methodologies for generating replicated data in a cost effective manner. The context of the debugging graph was pursued by simulation and experimentation. Simulation was done for the Basic model and the Log-Poisson model. Reasonable values of the parameters were assigned and used to generate simulated data which is then processed by the models in order to determine limitations on their accuracy. These experiments exploit the existing software and program specimens which are in AIR-LAB to measure the performance of reliability models. Author

N92-21348# Naval Postgraduate School, Monterey, CA.
MINIMIZATION OF MULTIPLE-VALUED PROGRAMMABLE LOGIC ARRAY USING SIMULATED ANNEALING M.S. Thesis
Robert C. Earle Dec. 1991 66 p
(AD-A245173) Avail: NTIS HC/MF A04 CSCL 12/5

Guaranteed minimal realizations of multi-valued programmable logic arrays can only be accomplished by an exhaustive search. Exhaustive search is not very realistic for complex expressions due to the immense amount of Central Processing Unit time required to reach a solution. To circumvent this problem, heuristics have been developed. They provide near-minimal solutions, but use substantially less CPU time. This thesis investigates a new type of heuristic which is built on the foundation of simple implicant operations controlled by an annealing process. This new type of heuristic is superior to existing heuristics with respect to minimization capability but requires more CPU time. GRA

N92-21352# Air Force Inst. of Tech., Wright-Patterson AFB, OH.
MIGRATING A C-BASED CAD TOOL TO AN OBJECT-ORIENTED DATABASE/C++ ENVIRONMENT: CONVERSION COSTS AND PERFORMANCE ANALYSIS
Mark A. Roth and Timothy M. Jacobs 6 Dec. 1991 26 p
(AD-A245182; AFIT/EN-TR-91-7) Avail: NTIS HC/MF A03
CSCL 12/5

The potential is examined of object-oriented databases to support complex design applications. To do this we migrated the Magic very large scale integrated (VLSI) circuit design tool written in the C language to a new environment in which Magic's existing file management code is replaced with a C++ language interface to the commercial object-oriented database management system (OODBMS) product Object Store. In our initial implementation, we found the performance of this tool as implemented on the OODBMS to be marginally faster than the tool as currently implemented with a flat file system in several critical areas. Increased functionality, including version management, multi-user concurrency control, and recovery, are now possible with the converted system. However, we found the conversion process itself time consuming and fraught with software engineering perils; the final product is not significantly more or less maintainable. We conclude that the conversion of large, complex systems should not be undertaken without experienced programmers nor without a pressing need for increased database functionality. Conversion of such systems to improve performance alone should be avoided. GRA

N92-21390# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
SIMNET CVCC RADIO PERFORMANCE MONITOR (RADMON) CSCI. VOLUME 1: SOFTWARE DESIGN DOCUMENT
Dec. 1991 151 p
(Contracts MDA972-89-C-0060; MDA972-90-C-0061)
(AD-A244606; BBN-7628-Vol-1) Avail: NTIS HC/MF A08
CSCL 25/5

This Software Design Document (SDD) establishes the design for the Computer Software Configuration Item (CSCI) identified as the Radio Performance Monitor (Radmon) of the Simulation Network (SIMNET) system. This SDD specifies the preliminary design for the Radmon CSCI. This includes descriptions of external interfaces and Computer Software Component (CSC) decomposition. Section (2), Referenced Documents, lists documents referenced in this SDD. Section (3), CSCI Design, provides an overview of this CSCI: its role, interfaces with the rest of the SIMNET system, and its internal organization. We also describe the individual CSC's that comprise this CSCI in terms of execution control and data flow, internal interfaces, and relationships among CSC's. This CSCI was developed according to the following software standards: X-Window System, version 11, (MIT 1987), and OSF/Motif (Open Software Foundation).
Author (GRA)

N92-21391# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
SIMNET CVCC RADIO PERFORMANCE MONITOR (RADMON) CSCI. VOLUME 2: ANNEX TO SOFTWARE DESIGN DOCUMENT: SOURCE CODE REFERENCE
Dec. 1991 108 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244607; BBN-7628-Vol-2) Avail: NTIS HC/MF A06
CSCL 25/5

The Radio Performance Monitor (Radmon) CSCI is used to monitor and analyze the performance of the SINCGARS radio simulation for SIMNET. Radmon monitors traffic on the simulation network and records information broadcast by the SINCGARS radio simulator hosts concerning every important state change of every simulated radio. Radmon maintains a running history of all state changes for each radio. The information that Radmon records can be saved in file and subsequently restored from that file. Radmon allows the user to browse through recorded data to examine interactions in detail. The recorded data can be summarized to show channel utilization, radio utilization, and other statistics of radio activity. The collected information can be presented in several ways: a stripchart display shows the activity of radios as a function of time; a connectivity map shows the communication paths that are usable; and a status display shows the detailed state of individual radios. GRA

N92-21392# BBN Systems and Technologies Corp., Cambridge, MA.
SIMNET PLAN VIEW DISPLAY USER MANUAL
Jun. 1991 25 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244617; BBN-7618) Avail: NTIS HC/MF A03 CSCL 05/2

This Simulation Network (SIMNET) project user manual describes the use of the Plan View Display (PVD) Workstation of the SIMNET hardware and software training system for vehicle crew training and operational training. The objective of the SIMNET program is to develop large-scale networking of military simulators for such vehicles as tanks and fixed-wing and rotary-wing aircraft. By utilizing a network of low-cost, full-crew simulators, each supported by its own set of microprocessors, the Army can conduct platoon-, company-, and battalion-level exercises incorporating all of the tactical, logistic, administrative, and communication elements that are critical to actual field operations. This technology will permit regular and intensive practice of team combat skills. A SIMNET simulator models the performance of the actual vehicle in mobility, fire control, and communication. A simulator contains crew stations, each of which has a set of controls comparable to those in the actual vehicle. The simulator's visual display system ensures that each crew member sees a depiction of the battlefield terrain as it would be seen from his vision blocks in the actual combat vehicle. SIMNET offers the crew member the opportunity to behave as he would in a real vehicle, succeeding or failing in assigned missions as he would in a battlefield exercise. SIMNET provides components for recording exercise data and for reviewing an exercise via a plan view (bird's-eye view) of the battlefield.
GRA

N92-21420# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
A CUTTING PLANE ALGORITHM FOR THE SINGLE MACHINE SCHEDULING PROBLEM WITH RELEASE TIMES
G. L. Nemhauser (Georgia Inst. of Tech., Atlanta.) and M. W. P. Savelsbergh Feb. 1991 25 p
(Grants NATO-CGR-901057; NSF ISI-87-61183; NATO-N62-316.89)
(Memo-COSOR-91-05; ETN-92-91125) Avail: NTIS HC/MF A03

A mixed integer programming formulation for the single machine scheduling problem with release times and the objective of minimizing the weighted sum of the start times is proposed. The basic formulation involves start time and sequence determining variables, and lower bounds on the start times. Its linear programming relaxation solves problems in which all release times are equal. For the general problem, good lower bounds are obtained by adding additional valid inequalities that are violated by the solution to the linear programming relaxation. Computational results are reported and some modifications based on including additional variables that are likely to give even better results are suggested.
ESA

N92-21497*# Research Inst. for Computing and Information Systems, Houston, TX.
CONFIGURATION MANAGEMENT PLAN. SYSTEM DEFINITION AND PROJECT DEVELOPMENT. REPOSITORY BASED SOFTWARE ENGINEERING (RBSE) PROGRAM
Charles McKay 31 Oct. 1991 49 p Prepared in cooperation with GHG Corp., Houston, TX
(Contract NCC9-16; RICIS Proj. SE-18)
(NASA-CR-190170; NAS 1.26:190170; RBSE-CMP-00001) Avail: NTIS HC/MF A03 CSCL 09B

This is the configuration management Plan for the AdaNet Repository Based Software Engineering (RBSE) contract. This document establishes the requirements and activities needed to ensure that the products developed for the AdaNet RBSE contract are accurately identified, that proposed changes to the product

are systematically evaluated and controlled, that the status of all change activity is known at all times, and that the product achieves its functional performance requirements and is accurately documented. H.A.

N92-21585# Allied-Signal Aerospace Co., Kansas City, MO.
COMPUTER PROGRAMS FOR GENERATING INVOLUTE GEARS
J. D. Emery and M. L. Wolf Feb. 1992 87 p
(Contract DE-AC04-76DP-00613)
(DE92-006620; KCP-613-4666) Avail: NTIS HC/MF A05

Methods and computer programs are given for computing the shapes of involute gears. A proof is given of conditions under which uniform angular velocity is maintained for a pair of interacting cams. A program is given for the animation of gear motion. It runs on an APOLLO 4500 computer. The other programs are general and are written in FORTRAN and C. DOE

N92-21759# Argonne National Lab., IL. Mathematics and Computer Science Div.
ADIFOR WORKING NOTE NO. 2: USING ADIFOR TO COMPUTE DENSE AND SPARSE JACOBIANS
C. Bischof and P. Hovland Jan. 1992 23 p
(Contract W-31-109-eng-38)
(DE92-007996; ANL/MCS-TM-158) Avail: NTIS HC/MF A03

ADIFOR is a source translator that, given a collection of FORTRAN subroutines for the computation of a 'function,' produces FORTRAN code for the computation of the derivatives of this function. More specifically, ADIFOR produces codesto compute the matrix-matrix product JS, where J is the Jacobian of the 'function' with respect to the user-defined independent variables, and S is the composition of the derivative objects corresponding to the independent variables. This interface is flexible; by setting S = x, one can compute the matrix-vector product Jx, or by setting S = I, one can compute the whole Jacobian J. Other initializations of S allow one to exploit a known sparsity structure of J. This paper illustrates the proper initialization of ADIFOR generated derivative codes and the exploitation of a known structure of J. DOE

N92-21778# National Inst. of Standards and Technology, Gaithersburg, MD.
SOFTWARE REENGINEERING: A CASE STUDY AND LESSONS LEARNED Final Report
M. K. Ruhl and M. T. Gunn Sep. 1991 42 p
(PB92-116417; NIST/SP-500/193) Avail: NTIS HC/MF A03; also available SOD HC $2.25 as 003-003-03100-3 CSCL 09B

The research is aimed at managers and technical personnel (both Federal Government and industry) who need to understand the concepts and issues of software reengineering; the use of Computer Aided Software Engineering (CASE) tools in the reengineering process; and the application of the technology to organizational problems. Software reengineering involves the use of existing software and documentation to specify requirements, design, documentation, and to produce software for a target platform. CASE tools are expected to play an important role in automating parts of the reengineering process. In the report, software reengineering and other related terms are defined and possible benefits that relate to the technology are described. The use of CASE tools for reengineering are examined. A case study that examines the feasibility and cost-effectiveness of software reengineering is described. Study results are addressed along with recommendations for organizations that are considering the use of reengineering. Author

N92-21847# Rolls-Royce Ltd., Derby (England).
THE PROPOSED REVISION TO RTCA DO178A AND ITS INFLUENCE ON SYSTEM DESIGN
C. D. Jack 1 Nov. 1990 7 p
(PNR-90821; ETN-92-90785) Copyright Avail: NTIS HC/MF A02

The RTCA document DO-178A entitled 'Software considerations in airborne systems and equipment certification' is introduced. Its importance in the avionics field is explained and some of the changes currently proposed and their possible impact on airborne systems and their certification are explained. Particular consideration is given to high-integrity systems, although the proposed changes could have effects on less critical systems. ESA

N92-21860# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT VEHICLE SIMULATION CSCI (5). VOLUME 3: SECTIONS 2.5.4 - 2.6.18.12.1
Jun. 1991 225 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244970; BBN-9108-Vol-3) Avail: NTIS HC/MF A10
CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes a Vehicle Simulation Computer Software Configuration Item (CSCI number 5) of the SIMNET hardware and software training system for vehicle crew training and operational training. This library determines the damages to the vehicle due to failures. Failures are divided into categories that indicate the method used for failure generation. The three categories are combat damage, stochastic failure, and deterministic failure. GRA

N92-21861# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT VEHICLE SIMULATION CSCI (5). VOLUME 4: APPENDICES
Jun. 1991 333 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244971; BBN-9108-Vol-4-App) Avail: NTIS HC/MF A15
CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes a Vehicle Simulation Computer Software Configuration Item (CSCI number 5) of the SIMNET hardware and software training system for vehicle crew training and operational training. The given header files are important to understanding the simulation code. They contain external references to routines externally accessible from the libraries. They contain external references to global variables and contain definitions of data types and constants for use as parameters. GRA

N92-21862# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT SAF WORKSTATION CSCI (6). VOLUME 1: SECTIONS 1.0 - 2.4.3.4.86
Jun. 1991 246 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244972; BBN-9109-Vol-1) Avail: NTIS HC/MF A11
CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the Semi-Automated Forces (SAF) Workstation Computer Software Configuration Item (CSCI number 6) of the SIMNET hardware and software training system for vehicle crew training and operational training. The SAF system provides a method of incorporating intelligent, realistic participants that do not require a vehicle simulation. A semi-automated vehicle is virtually indistinguishable from a manned vehicle simulation to all observers on the network. The SAF system provides command and control for up to a battalion of semi-automated vehicles. GRA

N92-21863# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT SAF WORKSTATION CSCI (6). VOLUME 2: SECTION 2.4.3.4.87 - 2.9.7 AND APPENDICES
Jun. 1991 248 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244973; BBN-9109-Vol-2-App) Avail: NTIS HC/MF A11
CSCL 12/5

A Simulation Network (SIMNET) project Software Design

Document is presented. The document describes the Semi-Automated Forces (SAF) Workstation Computer Software Configuration Item (CSCI number 6) of the SIMNET hardware and software training system for vehicle crew training and operational training. GRA

N92-21864# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT SAF PARAMETER EDITOR CSCI (7)
Jun. 1991 112 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244974; BBN-9110) Avail: NTIS HC/MF A06 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the Semi-Automated Forces (SAF) Parameter Editor Computer Software Configuration Item (CSCI number 7) of the SIMNET hardware and software training system for vehicle crew training and operational training. The function of the SAF segment is to allow a single operator at a SAF workstation to control a large number of vehicles out on the SIMNET battlefield. The SAF segment runs on two hardware platforms, the workstation computer and the simulation host computer. The SAF parameter editor is the component which is used to reconfigure the SAF and its operating characteristics without the need to reprogram it. GRA

N92-21865# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT SAF SIMULATION HOST CSCI (8). VOLUME 1: SECTIONS 1.0 - 2.7
Jun. 1991 241 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244975; BBN-9111-Vol-1) Avail: NTIS HC/MF A11 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the Semi-Automated Forces (SAF) Simulation Host Computer Software Configuration Item (CSCI number 8) of the SIMNET hardware and software training system for vehicle crew training and operational training. The SAF system provides the means for incorporating unmanned simulations of vehicles into a large-scale battle training simulation; therefore, it allows for a realistic representation of enemy forces, as well as portions of friendly forces, without requiring human crews to operate each component of these forces, thus eliminating the need for excessive numbers of personnel. GRA

N92-21866# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT SAF SIMULATION HOST CSCI (8). VOLUME 2: SECTIONS 2.7.1 - 2.15 AND APPENDICES
Jun. 1991 255 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244976; BBN-9111-Vol-2-App) Avail: NTIS HC/MF A12 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the Semi-Automated Forces (SAF) Simulation Host Computer Software Configuration Item (CSCI number 8) of the SIMNET hardware and software training system for vehicle crew training and operational training. GRA

N92-21867# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT CIG HOST CSCI (9A)
Jun. 1991 162 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244977; BBN-9112) Avail: NTIS HC/MF A08 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the Computer Image Generator (CIG) Host Computer Software Configuration Item (CSCI number 9A) of the SIMNET hardware and software training system for vehicle crew training and operational training. The CIG Host CSCI is the executable code that resides within the CIG and provides the Simulation Host (SIM) with an interface to the graphics hardware on the CIG. GRA

N92-21868# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT GT REAL-TIME SOFTWARE HOST CSCI (9B). VOLUME 1: SECTIONS 1.0 - 2.12.19.2
Jun. 1991 240 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244978; BBN-9117-Vol-1) Avail: NTIS HC/MF A11 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the GT Real-Time Software Host Computer Software Configuration Item (CSCI number 9B) of the SIMNET hardware and software training system for vehicle crew training and operational training. The Computer Image Generation (CIG) GT Host CSCI is the executable code that resides within the CIG and provides the Simulation Host (SIM) with an interface to the graphics hardware on the CIG. GRA

N92-21869# BBN Systems and Technologies Corp., Cambridge, MA.
SOFTWARE DESIGN DOCUMENT GT REAL-TIME SOFTWARE HOST CSCI (9B). VOLUME 2: SECTIONS 2.12.20 - 3.2 AND APPENDICES
Jun. 1991 222 p
(Contracts MDA972-89-C-0060; MDA972-89-C-0061)
(AD-A244984; BBN-9117-Vol-2-App) Avail: NTIS HC/MF A10 CSCL 12/5

A Simulation Network (SIMNET) project Software Design Document is presented. The document describes the GT Real-Time Software Host Computer Software Configuration Item (CSCI number 9B) of the SIMNET hardware and software training system for vehicle crew training and operational training. GRA

N92-21872# Office of Naval Research Liaison Office, Far East, APO San Francisco, CA.
INTERNATIONAL CONFERENCE ON COMPUTER INTEGRATED MANUFACTURING 1991: SUMMARY AND COMMENTS
D. K. Kahaner Nov. 1991 32 p Conference held in Singapore, 30 Sep. - 4 Oct. 1991
(PB92-115450) Avail: NTIS HC/MF A03 CSCL 09B

The International Conference on Computer Integrated Manufacturing 1991, (ICCIM'91) held September 30 to October 4, 1991, in Singapore is summarized. Singapore manufacturing science activities are focusing on building value added solutions using modern but well known ideas and equipment. There is a very aggressive education and training plan to increase the number of specialists in advanced manufacturing, exactly what is needed for a small country with few natural resources. Also, a discussion of the Singapore/Japan Artificial Intelligence Center and a visit to the National University of Singapore is presented. Author

N92-21979 Tel-Aviv Univ. (Israel). Dept. of Computer Science.
FASTER TREE PATTERN MATCHING M.S. Thesis
Edith Magen Jun. 1990 12 p
(ITN-92-85157) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Recently an O(nm(exp 0.75)polylog(m)) step algorithm was presented for tree pattern matching. This result is improved by designing a simple O(n(square root of m)polylog(m)) algorithm. Author (ISA)

N92-21271*# West Virginia Inst. of Tech., Montgomery. Dept. of Mathematics.
TARGET DETECTION USING FRACTAL GEOMETRY Final Report
J. Joseph Fuller *In* Texas A and M Univ., NASA/ASEE Summer

Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 9 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 09B

N92-21277*# Houston Univ., TX. Dept. of Computer Science.
TRAINING, QUALITY ASSURANCE FACTORS, AND TOOLS INVESTIGATION: A WORK REPORT AND SUGGESTIONS ON SOFTWARE QUALITY ASSURANCE Final Report
Pen-Nan Lee *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 10 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 09B

N92-21313*# Houston Univ., TX. Dept. of Curriculum and Instruction.
AN INTELLIGENT COMPUTER-AIDED TRAINING SYSTEM (CAT) FOR DIAGNOSING ADULT ILLITERATES: INTEGRATING NASA TECHNOLOGY INTO WORKPLACE LITERACY Final Report
David B. Yaden, Jr. *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 12 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N92-21079# Superconducting Super Collider Lab., Dallas, TX.
PARALLEL PROCESSING AT THE SSC: THE FACT AND THE FICTION
G. Bourianoff and B. Cole Oct. 1991 4 p Presented at the 5th International Committee for Future Accelerators (ICFA) Beam Dynamics Workshop, Corpus Christi, TX, 3-8 Oct. 1991 Submitted for publication
(Contract DE-AC35-89ER-40486)
(DE92-007653; SSCL-Preprint-19; CONF-9110243-11) Avail: NTIS HC/MF A01

Accurately modelling the behavior of particles circulating in accelerators is a computationally demanding task. The particle tracking code currently in use at SSC is based upon a 'thin element' analysis (TEAPOT). In this model each magnet in the lattice is described by a thin element at which the particle experiences an impulsive kick. Each kick requires approximately 200 floating point operations ('FLOP'). For the SSC collider lattice consisting of 10(exp 4) elements, performing a tracking of study for a set of 100 particles for 10(exp 7) turns would require 2 x 10(exp 15) FLOPS. Even on a machine capable of 100 MFLOP/sec (MFLOPS), this would require 2 times 10(exp 7) seconds, and many such runs are necessary. It should be noted that the accuracy with which the kicks are to be calculated is important: the large number of iterations involved will magnify the effects of small errors. The inability of current computational resources to effectively perform the full calculation motivates the migration of this calculation to the most powerful computers available. A survey of the current research into new technologies for superconducting reveals that the supercomputers of the future will be parallel in nature. Further, numerous such machines exist today, and are being used to solve other difficult problems. Thus it seems clear that it is not early to begin developing the capability to develop tracking codes for parallel architectures. This report discusses implementing parallel processing on the SCC. DOE

N92-21091# Leiden Univ. (Netherlands). Dept. of Mathematics and Computer Science.
ON THE ASSIGNMENT OF CUSTOMERS TO PARALLEL QUEUES
Arie Hordijk and Ger Koole 1991 19 p
(TW-91-08; ETN-92-90979) Avail: NTIS HC/MF A03

A discrete time model with m queues and finite or infinite buffers is considered. Each queue has its own geometric server. For a large class of cost functions it is shown that the customer should be sent to the queue with the faster server if his queue is shorter. This rule specifies to the shortest queue policy in the symmetric case. In case there is no waiting room it says that the fastest server policy is optimal. Although dynamic programming is used the optimality of these policies is shown in distribution. The results on the structure of the optimal policy are also true in a tandem queue with the assigning control in the last node. ESA

N92-21105# Lawrence Livermore National Lab., CA.
GANG SCHEDULING A PARALLEL MACHINE
B. C. Gorda and E. D. Brooks, III Dec. 1991 11 p Presented at the Conference on Programming Environments for Parallel Computing, Edinburgh (United Kingdom), 6-8 Apr. 1992
(Contract W-7405-eng-48)
(DE92-007309; UCRL-JC-107020-Rev-1; CONF-920484-1-Rev-1)
Avail: NTIS HC/MF A03

Program development on parallel machines can be a nightmare of scheduling headaches. We have developed a portable time sharing mechanism to handle the problem of scheduling gangs of processes. User programs and their gangs of processes are put to sleep and awakened by the gang scheduler to provide a time sharing environment. Time quantum are adjusted according to priority queues and a system of fair share accounting. The initial platform for this software is the 128 processor BBN TC2000 in use in the Massively Parallel Computing Initiative at the Lawrence Livermore National Laboratory. DOE

N92-21139# Argonne National Lab., IL.
PARALLEL PROGRAMMING WITH PCN
I. Foster and S. Tuecke Dec. 1991 118 p Revised
(Contract W-31-109-eng-38)
(DE92-006864; ANL-91/32-Rev-1) Avail: NTIS HC/MF A06

PCN is a system for developing and executing parallel programs. It comprises a high-level programming language, tools for developing and debugging programs in this language, and interfaces to Fortran and C that allow the reuse of existing code in multilingual parallel programs. Programs developed using PCN are portable across many different workstations, networks, and parallel computers. This document provides all the information required to develop parallel programs with the PCN programming system. In includes both tutorial and reference material. It also presents the basic concepts that underly PCN, particularly where these are likely to be unfamiliar to the reader, and provides pointers to other documentation on the PCN language, programming techniques, and tools. PCN is in the public domain. The latest version of both the software and this manual can be obtained by anonymous FTP from Argonne National Laboratory in the directory pub/pcn at info.mcs.anl.gov (c.f. Appendix A). DOE

N92-21291# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
MULTIPROCESSOR SCHEDULING WITH COMMUNICATION DELAYS
B. Veltman, B. J. Lageweg, and J. K. Lenstra (Center for Mathematics and Computer Science, Amsterdam, Netherlands) Sep. 1990 16 p
(Memo-COSOR-90-33; ETN-92-91110) Avail: NTIS HC/MF A03

Scheduling problems that arise when a parallel computation is executed on a multiprocessor are addressed. A model that allows for communication delays between precedence related tasks is defined, and a classification of various submodels is proposed. Complexity results and optimization and approximation algorithms that are presented in the literature are reviewed. ESA

N92-21418# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
PERIODIC MULTIPROCESSING SCHEDULING
Jan Korst, Emile Aarts, Jan Karel Lenstra (Center for Mathematics and Computer Science, Amsterdam, Netherlands), and Jaap Wessels Dec. 1990 21 p
(Memo-COSOR-90-49; ETN-92-91123) Avail: NTIS HC/MF A03

A number of scheduling and assignment problems are presented

involving the execution of periodic operations in a multiprocessor environment. The computational complexity of these problems is considered and approximation algorithms for operations with identical periods as well as for operations with arbitrary integer periods are proposed. This interest in periodic scheduling originates from the field of real time video signal processing where a sample of video signal is processed at a constant high frequency (10 to 100 MHz) on a network of processors. ESA

N92-21437# National Inst. of Standards and Technology, Gaithersburg, MD. Advanced Systems Div.
NORTH AMERICAN ISDN USERS' FORUM AGREEMENTS ON INTEGRATED SERVICES DIGITAL NETWORK Final Report
S. A. Wakid and K. M. Roberts Sep. 1991 152 p
(PB92-102219; NIST/SP-500/195) Avail: NTIS HC/MF A08; also available SOD HC $9.00 as 003-003-03110-1 CSCL 09B

Compiled here are the North American Integrated Services Digital Network (ISDN) Users' Forum (NIU-Forum) agreements for an ISDN developed and approved in the NIU-Forum as of November 1990. These agreements cover Layer 1 Basic Rate Interface (BRI) at the U, and S/T reference points; Layer 1 Primary Rate Interface (PRI) at the U reference point; Layer 2 BRI and PRI; Layer 3 BRI Basic Call Control for Class 1 equipment; Layer 3 PRI Basic Call Control for Class 2 equipment; and Generic Control procedures for Class 1 BRI Supplementary Services. In addition, the conformance tests which have been completed by the NIU-Forum are referenced. These include Layer 1 BRI S/T interface; and Layer 2 BRI Link Access Procedure, D-channel (LAPD). Finally, the Application Profile for four of the incoming Call Management applications which have been submitted to the NIU-Forum are given. Author

N92-21545*# Illinois Univ., Urbana. Coordinated Science Lab.
REDUCING SPACE OVERHEAD FOR INDEPENDENDENT CHECKPOINTING
Yi-Min Wang, Pi-Yu Chung, In-Jen Lin, and W. Kent Fuchs 11 Mar. 1992 35 p
(Contract NAG1-613; N00014-91-J-1283)
(NASA-CR-190096; NAS 1.26:190096; UILU-ENG-92-2209; CRHC-92-06) Avail: NTIS HC/MF A03 CSCL 09B

The main disadvantages of independent checkpointing are the possible domino effect and the associated storage space overhead for maintaining multiple checkpoints. In most previous work, it has been assumed that only the checkpoints older than the current global recovery line can be discarded. Here, we generalize a notion of recovery line to potential recovery line. Only the checkpoints belonging to at least one of the potential recovery lines cannot be discarded. By using the model of maximum-sized antichains on a partially ordered set, an efficient algorithm is developed for finding all non-discardable checkpoints, and we show that the number of non-discardable checkpoints cannot exceed $N(N+1)/2$, where N is the number of processors. Communication trace driven simulation for several hypercube programs is performed to show the benefit of the proposed algorithm for real applications. Author

N92-21551# Westinghouse Hanford Co., Richland, WA.
MASSIVELY PARALLEL MONTE CARLO CALCULATIONS WITH WORKSTATIONS
L. L. Carter and K. E. Hillesland Dec. 1991 7 p Presented at the Meeting on New Horizons in Radiation Protection and Shielding, Pasco, WA, 26 Apr. - 1 May 1992
(Contract DE-AC06-87RL-10930)
(DE92-007661; WHC-SA-1309; CONF-920431-17) Avail: NTIS HC/MF A02

Moderately priced desktop workstations execute scaler computer programs at computation rates that may even exceed 10 pct. of that for a single processor of a super computer. It is cost effective to use these workstations on 'number crunching' applications at nights and weekends when they would otherwise be idle. A modification to Version 4 of the Monte Carlo neutron photon computer program has been implemented that allows for independent random walk calculations to be easily combined. This potentially allows linking together calculations on a single Monte Carlo problem involving from tens to hundreds, or even thousands, of overnight or weekend calculations on workstations. The overhead cost anticipated for the computer time to combine the calculations is estimated to typically be the order of 1 pct. The technique was demonstrated in two example problems. DOE

N92-21576# Sandia National Labs., Albuquerque, NM.
A COMPARISON OF PRECONDITIONED NONSYMMETRIC KRYLOV METHODS ON A LARGE-SCALE MIMD MACHINE
J. N. Shadid and R. S. Tuminaro 2 Jan. 1992 35 p Presented at the Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, 9-16 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006838; SAND-91-0333C; CONF-920472-1) Avail: NTIS HC/MF A03

Many complex physical processes are modeled by coupled systems of partial differential equations (PDEs). Often, the numerical approximation of these PDEs requires the solution of large sparse nonsymmetric systems of equations. In this paper we compare the parallel performance of a number of preconditioned Krylov subspace methods on a large scale MIMD machine. These methods are among the most robust and efficient iterative algorithms for the solution of large sparse linear systems. They are easy to implement on various architectures and work well on a wide variety of important problems. In this comparison we focus on the parallel issues associated with both local preconditioners (those that combine information from the entire domain). The various preconditioners are applied to a variety of PDE problems within the GMRES, CCGS, BiCGSTAB, and QMRCGS methods. Conclusions are drawn on the effectiveness of the different schemes based on results obtained from a 1024 processor a nCUBE 2 hypercube. DOE

N92-21775# Stanford Univ., CA.
ASYNCHRONOUS DESIGN FOR PARALLEL PROCESSING ARCHITECTURES Semiannual Report, Jul. - Dec. 1991
Teresa H. Meng Dec. 1991 2 p
(Contract N00014-89-J-3036)
(AD-A244370) Avail: NTIS HC/MF A01 CSCL 12/6

The objective of this research is to provide a design methodology for connecting heterogeneous hardware modules that have inherently different functional and timing behavior. With the constraints dictated by the system-level interaction, we need to adopt a modular design approach without compromising the global performance. The main task of this effort will be the development of the theory for optimal interface circuits synthesis from high-level specification, with emphasis on testability and performance. In July-Dec 1991 we have concentrated on the gate-level synthesis of asynchronous control circuits and introducing timing information into the synthesis process to increase circuit performance. GRA

N92-21823# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Computer and Information Science.
COMPARISON BETWEEN CLASSICAL AND NEURAL NETWORK METHODS IN TEXTURE RECOGNITION
A. Visa 1990 15 p
(PB92-134345; ISBN-951-22-0414-2; A-13) Avail: NTIS HC/MF A03 CSCL 09B

A neural networks based method for stochastic texture classification and recognition was developed recently. Here, the method is compared with K-means and K-nearest neighbor classification using both simulated and real data. The feature vectors are the reduced co-occurrence matrices at six different resolution levels. This means that the dimension of the feature vector is 18. The conclusion is that the K-means method is the least successful. The developed method is slightly more powerful than the k-nearest neighbor method for map sizes 9x9 and 10x10. With the map size 8x8, the developed method is slightly worse than the k-nearest neighbor method. The differences are, however, quite small. This means that the choice of classification method depends mainly on other aspects like computational complexity

and learning capability. For texture recognition, it is essential that the actual classification method is general enough to discriminate between symmetrical clusters. Author

N92-21975*# Old Dominion Univ., Norfolk, VA. Dept. of Computer Science.
EXTREMELY HIGH DATA RATE, RELIABLE NETWORK SYSTEMS RESEARCH Annual Report, 16 Aug. 1990 - 31 Aug. 1991
E. C. Foudriat, K. Maly, R. Mukkamala, N. D. Murray (National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.), and C. M. Overstreet 15 Jul. 1991 274 p
(Grant NAG1-908)
(NASA-CR-190141; NAS 1.26:190141) Avail: NTIS HC/MF A12 CSCL 09B

One effort to achieve high speed data networks is parallel media access control. In order to understand the behavior of several factors affecting the behavior of the system, a general purpose media access simulator was developed. The results were encouraging and the current work on token rings is to be extended to broader structures. Author

N92-21996# Leiden Univ. (Netherlands). Dept. of Mathematics and Computer Science.
ASSIGNING MULTIPLE CUSTOMER CLASSES TO PARALLEL SERVERS
Ger Koole 1991 7 p
(TW-91-07; ETN-92-90978) Avail: NTIS HC/MF A02

Customers of K different classes arrive at M heterogeneous exponential servers. Upon arrival a customer may be blocked or sent to one of the free servers, depending on the state of the servers and the class of the customer. There are class dependent blocking costs. The optical policy is considered. The following are concluded: when a customer is allowed to enter, it should be sent to the fastest free server; customers of the class with highest blocking cost should never be blocked. Two monotonicity results are given in conclusion. ESA

N92-21998# Oxford Univ. (England). Robotics Research Group.
COMMUNICATION IN DECENTRALIZED DATA-FUSION SYSTEMS
S. Grime, H. F. Durrant-Whyte, and P. Ho 11 Sep. 1991 34 p
(Grant SERC-IED/1199)
(OUEL-1900/91; ETN-92-91090) Avail: NTIS HC/MF A03

The problem of communication in dencentralized data fusion systems is addressed. Sensor networks in which there is no central fusion center and in which no single sensor node has global knowledge of network topology, only communicating to its nearest neighbors are considered. Each sensor in the network takes local observations and generates (using a Kalman filter) a partial estimate of a common state. It communicates this to neighboring nodes where it is assimilated to provide a neighborhood and subsequently, a global estimator. The key problem in such networks is to find what should be communicated so that each node eventually obtains all relevant information available to the network without 'double counting'. It is first shown that in a fully connected network a single estimator per node is sufficient for a solution to the problem. It is also shown that in tree connected networks, each node must, in addition, maintain an estimator for each communication channel. Finally, it is shown that although simple network loops may also be solved, the general case of arbitrary topology networks is not soluble within the constraints imposed. In the conclusion, possible suboptimal solutions to this problem are discussed. ESA

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N92-21090# Technische Univ., Delft (Netherlands).
MODEL REFERENCE ADAPTIVE CONTROL: BRIDGING THE GAP BETWEEN THEORY AND PRACTICE Ph.D. Thesis
Hans Butler 1990 246 p
(ETN-92-90975) Avail: NTIS HC/MF A11

A study intended to be part of a link bridging theoretical and practical viewpoints of Model Reference Adaptive Control (MRAC) is presented. Although MRAC theory is growing slowly towards lessening the strict assumptions lying at the basis of the design, the theoretical results are mostly not in a form that can be directly applied. On the other hand, practical MRAC applications almost always make use of simple controller structures, while a proper operation is achieved by heuristic measures. The most important issue is the observation that, in practice, it is in many cases not sensible to impose a fixed reference model response onto a process, and thus 'losing contact'. An introduction to MRAC is given, the design of continuous time MRAC systems is described, and robustness properties of MRAC systems is addressed. The MRAC design is extended to the discrete time case. The method of 'reference model decomposition' that allows inclusion of knowledge of the structure of unmodeled dynamics on the adaptive system is presented. A practical application of MRAC to a direct drive DC motor shows a similar adjustment of the reference model to the actual process capabilities. The decomposition approach is extended to the situation where the process suffers from known external disturbances. Conclusions regarding the practical useability of MRAC and results obtained in the study are presented. ESA

N92-21157# Naval Postgraduate School, Monterey, CA.
COMPLIANCE OF A ROBOTIC FINGER JOINT M.S. Thesis
Yavuz Turkgenci Jun. 1991 105 p
(AD-A245226) Avail: NTIS HC/MF A06 CSCL 12/9

Adaptive compliance control of a robotic single joint was studied to control the amount of torque applied on an object by an end effector, which is actuated by an electric motor through a gearbox. For this reason, an adaptive control system was designed. Variation in stiffness and compliance was observed by simulating the system with MATRIX package program. After observing theoretical variation of the stiffness and the compliance, experiments were done to observe and prove the stiffness control theory. The proved theory was then applied to a prototype robotic finger joint actuated by a small DC motor. GRA

N92-21160# Nevada Univ., Las Vegas.
THE DYNAMIC RESPONSE OF A FLEXIBLE THREE-LINK ROBOT USING STRAIN GAGES AND LAGRANGE POLYNOMIALS
Samaan G. Ladkany 1991 22 p
(Contract DAAL03-87-G-0004)
(AD-A245250; MS91-388; ARO-24960.68-MA-REP) Avail: NTIS HC/MF A03 CSCL 12/6

A method for modeling elastic robot kinematics is presented in this paper. The method uses the input of strain gages and joint encoders to determine the deflection of the links in in-plane and out-of-plane directions. Torsional flexures also are measured using strain rosettes. This information determines the end effector location which can be then used by the robot controller to damp the robot vibrations. GRA

N92-21256# Oxford Univ. (England). Dept. of Engineering Science.
CGPC WITH GUARANTEED STABILITY PROPERTIES
H. Demircioglu and D. W. Clarke 1991 30 p
(OUEL-1890/91; ETN-92-91086) Avail: NTIS HC/MF A03

Two modified versions of Continuous time Generalized Predictive Control (CGPC): CGPC with end point state constraints (CGPC-C) and CGPC with end point state weighting (CGPC-W)

are presented. It is shown that both CGPC-C and CGPC-W have guaranteed stability properties whereas stability is not guaranteed in CGPC. The relationships between the three methods are also discussed and it is shown that CGPC-W included the other two, namely CGPC and CGPC-C, as submethods. Some features of the methods are also illustrated by simulations. ESA

N92-21362# Naval Postgraduate School, Monterey, CA.
BACK-PROPAGATION NEURAL NETWORKS IN ADAPTIVE CONTROL OF UNKNOWN NONLINEAR SYSTEM M.S. Thesis
Chin-Hock Teo Dec. 1991 114 p
(AD-A244673) Avail: NTIS HC/MF A06 CSCL 12/6

The objective of this research is to develop a Back-propagation Neural Network (BNN) to control certain classes of unknown nonlinear systems and explore the network's capabilities. The structure of the Direct Model Reference Adaptive Controller (DMRAC) for Linear Time Invariant (LTI) systems with unknown parameters is first analyzed. This structure is then extended using a BNN for adaptive control of unknown nonlinear systems. The specific structure of the BNN DMRAC is developed for the control of four general classes of nonlinear systems modelled in discrete time. Experiments are conducted by placing a representative system from each class under the BNN's control. The conditions under which the BNN DMRAC can successfully control these systems are investigated. The design and training of the BNN are also studied. The results of the experiments show that the BNN DMRAC works for the representative systems considered, while the conventional least-squares estimator DMRAC fails. Based on analysis and experimental findings, some general conditions required to ensure that this technique works are postulated and discussed. General guidelines used to achieve the stability of the BNN learning process and good learning convergence are also discussed. To establish this as a general and significant control technique, further research is required to establish analytically, the conditions for stability of the controlled system, and to develop more specific rules and guidelines in the BNN design and training. GRA

N92-21382# Naval Surface Warfare Center, Dahlgren, VA.
CONNECTIONIST APPROACH TO TRANSFORMATION RECOVERY USING VISUAL GRADIENT DESCENT
George W. Rogers, Jeffrey L. Solka, Donald R. Vermillion, and Carey E. Priebe Nov. 1991 33 p
(AD-A244703; NAVSWC-TR-91-609) Avail: NTIS HC/MF A03 CSCL 12/7

Given an object and a copy of itself produced by an unknown two dimensional affine transformation, a new neural network architecture has been developed that recovers this transformation by minimizing the symmetric difference between the object and the copy. This architecture performs a gradient descent in symmetric difference error space and is designated as visual gradient descent (VGD). The VGD network has applications to both two- and three-dimensional model based automatic target recognition (ATR) and image compression using iterated function systems. GRA

N92-21394# Central Research Inst. of Electric Power Industry, Tokyo (Japan).
AUTOMATIC RECOGNITION OF FACILITY DRAWINGS, PART 1
C. Nakajima and T. Yazawa Apr. 1991 24 p In JAPANESE; ENGLISH summary
(DE92-769317; CRIE-Y-90022) Avail: NTIS HC/MF A03

By applying artificial-intelligence pattern recognition technology, a technology was developed to automatically read the contents of a facility's configuration drawings, and efficiently computerize them. The image identification by the first system stage determines, after optically reading figures automatically, what kind of figures are used in the drawing. The second stage is the meaning-understanding process which identifies the meaning of the drawings and stores them in a data base. The identification was tested using an electronic circuit drawing expressing a binary adder as an example. The image identification process identified correctly the symbols indicating logic elements and the wiring diagram. However, the process committed some erroneous identifications in characters. As a result of comparing a drawing model describing the general circuitry of the binary adder with the result obtained from the above figure identification process, it was found that the meaning-understanding process also makes a correct determination. DOE

N92-21414 Arizona Univ., Tucson.
NEURAL NETWORK-BASED APPROACHES TO CONTROLLER DESIGN FOR ROBOT MANIPULATORS Ph.D. Thesis
Ahmet Karakasoglu 1991 263 p
Avail: Univ. Microfilms Order No. DA9202083

The development of neural network-based methods to the control of robot manipulators is addressed, and focus is on three different approaches for this purpose. In the first approach, an implementation of an intelligent adaptive control strategy in the execution of complex trajectory tracking tasks by using multilayer neural networks is demonstrated by exploiting the pattern classification capability of these nets. The network training is provided by a rule-based controller which is programmed to switch an appropriate adaptive control algorithm for each component type of motion constituting the overall trajectory tracking task. The second approach is based on the capability of trained neural networks for approximating input-output mappings. The use of dynamical networks with recurrent connections and efficient supervised training policies for the identification and adaptive control of a nonlinear process are discussed and a decentralized adaptive control strategy for a class on nonlinear dynamical systems with specific application to robotic manipulators is presented. An effective integration of the modeling of inverse dynamics property of neural nets with the robustness to unknown disturbances property of variable structure control systems is considered as the third approach. This methodology yields a viable procedure for selecting the control parameters adaptively and for designing a model-following adaptive control scheme for a class of nonlinear dynamical systems with application to robot manipulators. Dissert. Abstr.

N92-21997# Oxford Univ. (England). Dept. of Engineering Science.
FAUSTGPC USER'S GUIDE
D. W. Clarke 24 Sep. 1991 28 p
(OUEL-1893/91; ETN-92-91088) Avail: NTIS HC/MF A03

The user manual for FAUSTGPC, a program written in C for operation on personal computers and compatibles is presented. Its principal function is to act as a test bed and demonstrator for adaptive predictive control, in particular, Genralized Predictive Control (GPC), either by using internal simulation or by being connected via an ADC/DAC subsystem to a real time process. Emphasis is on ease of use, with a window/mouse operating environment and a set of 'plain English' commands. As a research demonstration tool it has great flexibility, since all internal variables are accessible for inspection and modification (even up to deciding on the color of individual graphs). The real time mode enables GPC to act either as the principal controller in a loop, or it can be inserted in cascade with other controllers with set point information being received in analog form. ESA

N92-22027 Tel-Aviv Univ. (Israel). School of Physics and Astronomy.
CHAOTIC BEHAVIOR OF A NEURAL NETWORK WITH DYNAMICAL THRESHOLDS M.S. Thesis
Ofer Hendin Nov. 1990 84 p
(ITN-92-85159) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

This work investigates the properties of a neural-network model employing excitatory and inhibitory neurons with dynamical thresholds. Since the subject of the work relates both to biology and the phenomenon called chaos, a short description of the biological neuron is presented, together with a review of some of the mathematical tools used for analyzing chaotic systems. The network experiences motion between centers of attraction - the

memory patterns. Small variations in the parameters of the model lead to big qualitative differences in the behavior of the solutions. The motion in phase space turns from periodic into quasi-periodic and, on further change of the parameters, chaotic motion develops. In the chaotic phase, the general character of the dynamics of this model is convergence to centers of attraction on short time scales and divergence on long ones. The dynamics of the model and its sensitive dependence on the parameters are studied by use of both analytical and numerical methods. Lyapunov exponents of different attractors are calculated and a special method of using the information derived from local contributions to the Lyapunov exponents is used. It is shown that there are regions in the space of the parameters where the system is chaotic and we find that it turns chaotic via the route of intermittency. Further support for the intermittent nature is given by a Poincare map of an attractor. The basin of attraction of a closed orbit is shown to have a fractal shape and the dimension of the motion is calculated.
Author (ISA)

N92-21301*# Houston Univ., TX. Dept. of Applied Mathematical Sciences.
FUZZY LOGIC PATH PLANNING SYSTEM FOR COLLISION AVOIDANCE BY AN AUTONOMOUS ROVER VEHICLE Final Report
Michael G. Murphy *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 10 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

N92-21303*# Clemson Univ., SC. Dept. of Mathematical Sciences.
NEURAL ARCHITECTURES FOR CONTROL Final Report
James K. Peterson *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 17 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N92-21158# Naval Postgraduate School, Monterey, CA.
INVESTIGATION INTO EFFICIENT CONVERSION METHODS BETWEEN RESIDUE AND BINARY SYSTEMS M.S. Thesis
David E. Gilbert Sep. 1991 56 p
(AD-A245227) Avail: NTIS HC/MF A04 CSCL 12/1

Residue number systems (RNS) can efficiently perform addition, subtraction, and multiplication in a parallel and fault tolerant manner. Because of this, they hold significant promise for use in digital signal processing, where high speed arithmetic operators are needed. However, the difficulties in using RNS, such as magnitude comparison between two RNS values, division, and determining overflow or under-flow out of system range, have prevented more widespread use of these systems. This thesis investigates traditional methods to perform comparisons and to propose some new ones. Proposals include residue number system with quotient (RNS-Q), residue number system quotient-on-demand (RNS-QD), and pipelined conversions from traditional RNS to a mixed radix representation. These proposals will be compared with traditional methods with respect to silicon area needed for implementation, speed with which they can be developed, and VLSI techniques utilized to carry out the design. GRA

N92-21185# Argonne National Lab., IL.
AN IMPROVED QUASISTATIC OPTION FOR THE DIF3D NODAL KINETICS CODE
T. A. Taiwo and H. S. Khalil 1991 14 p Presented at the Advances in Reactor Physics, Charleston, SC, 8-11 Mar. 1992
(Contract W-31-109-eng-38)
(DE92-007376; ANL/CP-73636; CONF-920308-11) Avail: NTIS HC/MF A03

An improved quasistatic scheme is formulated for solution of the time-dependent DIF3D nodal equations in hexagonal-z geometry. This scheme has been implemented, along with adiabatic and point kinetics solution options, in the DIF3D hexagonal-z nodal kinetics code. The improved quasistatic method is shown to permit significant reduction in computing time, even for transients involving pronounced changes in flux shape. The achievable computing time reduction, in addition to being problem dependent, has also been found to be larger when greater accuracy is required in the computed results. DOE

N92-21250# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
NEURAL NETWORKS AND PRODUCTION PLANNING
P. J. Zwietering, M. J. A. L. vanKraaij, E. H. L. Aarts (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands), and J. Wessels Jul. 1991 20 p
(Memo-COSOR-91-15; ISSN-0926-4493; ETN-92-91133) Avail: NTIS HC/MF A03

Because of the combination of classification, association, adaptation, and pattern recognition capabilities, neural networks are shown to be suitable for solving problems in production planning with uncertain and non stationary demand. It is demonstrated that a properly designed and trained multilayered perceptron outperforms traditional algorithms for the rolling horizon version of the dynamic lotsizing problem. Formal arguments are supported by numerical experiments. ESA

N92-21257# National Inst. of Standards and Technology, Gaithersburg, MD.
NBS-INA: THE INSTITUTE FOR NUMERICAL ANALYSIS, UCLA, 1947 - 1954 Final Report
Magnus R. Hestenes and John Todd (California Inst. of Tech., Pasadena.) Aug. 1991 185 p Sponsored by Mathematical Association of America
(PB92-112408; NIST/SP-730) Avail: NTIS HC/MF A09; also available SOD HC $11.00 as 003-003-03094-5 CSCL 12A

A history of the Institute for Numerical Analysis (INA), with special emphasis on its research program during the period 1947 to 1956, is given. The history is primarily concerned with the development of mathematics pertinent to solving numerical computations. The development could only happen if some mathematicians were proficient in handling electronic digital computers. To insure that there would be some, the INA was constituted. It was well funded and could attract first class mathematicians to take a year off for research at INA. They were in the midst of people solving problems of considerable difficulty using digital computers. They were thus enticed into using them. When this happened, many important developments emerged. The history is centered around these people and discusses who they were, what their interests were, and what they did. Author

N92-21318# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
LINEAR QUADRATIC PROBLEMS WITH INDEFINITE COST FOR DISCRETE TIME SYSTEMS
A. C. M. Ran (Vrije Univ., Amsterdam, Netherlands) and H. L. Trentelman 30 Nov. 1990 33 p
(Memo-COSOR-90-45; ETN-92-91120) Avail: NTIS HC/MF A03

The discrete time infinite horizon linear quadratic problem with indefinite cost criterion is discussed. Given a discrete time linear system, an indefinite cost functional, and a linear subspace of the state space, the problem of minimizing the cost functional over all inputs that force the state trajectory to converge to the given subspace is considered. A geometric characterization of the set of all hermitian solutions of the discrete time algebraic Riccati equation is given. This characterization forms the discrete time counterpart of the geometric characterization of the set of all real symmetric solutions of the continuous time algebraic Riccati equation. In the set of all hermitian solutions of the Riccati equation the solution that leads to the optimal cost for the above mentioned linear quadratic problems is identified. Necessary and sufficient conditions for the existence of optimal controls are given. ESA

N92-21319# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE DISTURBANCE DECOUPLING PROBLEM WITH MEASUREMENT FEEDBACK AND STABILITY FOR SYSTEMS WITH DIRECT FEEDTHROUGH MATRICES
A. A. Stoorvogel and J. W. vanderWoude (Technische Univ., Delft, Netherlands) 30 Nov. 1990 18 p
(Memo-COSOR-90-46; ETN-92-91121) Avail: NTIS HC/MF A03

The known results of the Disturbance Decoupling Problem with Measurement feedback and internal Stability (DDPMS) are extended to include non-zero direct feedthrough matrices. Necessary and sufficient conditions for the solvability of the DDPMS are expressed in three subspace inclusions. ESA

N92-21355# Naval Postgraduate School, Monterey, CA.
MINIMUM TIME CONTROL OF A THIRD ORDER REGULATOR M.S. Thesis
Kayhan Vardareri Dec. 1991 70 p
(AD-A245187) Avail: NTIS HC/MF A04 CSCL 12/2

The optimal minimum time control is applied to a third order regulator. From Pontryagin, the optimal control must minimize the Hamiltonian. The control is a function of the states. The state space partitioned into regions where the optimal control is either plus or minus N (the maximum control effort) which is bang-bang control. GRA

N92-21388# Lowell Univ., MA. Dept. of Electrical Engineering.
STUDIES OF QUANTITATIVE METHODS FOR IMAGING FROM SCATTERED FIELDS Report, 8 Apr. - 30 Nov. 1991
M. A. Fiddy 30 Nov. 1991 10 p
(Contract N00014-89-J-1158)
(AD-A244598) Avail: NTIS HC/MF A02 CSCL 12/3

A detailed analysis of the differences between first Born and Rytov approximations was carried out. In anticipation of the next phase of this project, namely to consider the inverse scattering problem for nonlinear medium, we have been studying the writing of structures into nonlinear media, specifically photorefractive crystals. This experimental and theoretical work has been directed toward writing structures with intense beams and reading with work beams; the partial erasure on reading was a problem. However, we have identified possible methods for storing information more permanently, which is important in its own right because of the widespread interest in these materials for optical data storage. Data sets from targets have now been taken using the bistatic procedure. This is much faster and avoids having to rotate the target to change the incidence angle, and data are now available on concentric circular loci in k-space. This allows the data to be more uniformly spread in the Fourier domain and leads to improved interpolations of that data onto a Cartesian grid prior to taking the inverse Fourier transform. However, we are finding that the lack of data near the k-space origin leads to increased error in the interpolation, compared to data on arcs. GRA

N92-21402# Vrije Univ., Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
ELLIPTIC CURVES AND REAL ALGEBRAIC MORPHISMS
J. Bochnak and W. Kucharz Oct. 1990 50 p
(Grants NSF DMS-89-05538; NSF DMS-90-96119)
(PB91-219394; WS-370) Avail: NTIS HC/MF A03 CSCL 12A

The classic theorem of Stone-Weierstrass implies that R(X,Y) is dense in C(sup infinity)(X,Y) if Y = R(sup k). This result is extended to other target spaces Y, the simplest case to consider being Y = S(sup k), where S(sup k) is the unit sphere. Given f in C(sup infinity)(X,Y) there are two conditions to consider: (1) f belongs to the closure of R(X,Y) in C(sup infinity)(X,Y), that is, f can be approximated in the C(sup infinity) topology by regular mappings, and (2) f is homotopic to a regular mapping. In general neither (1) nor (2) is satisfied, even for Y = S(sup k). Significant progress is presented in the investigation of (1) (or, equivalently (2)) for Y = S(sup 2). The main results concern the case where X is a surface or a product of compact affine nonsingular real algebraic curves. Explicitly described is the closure of R(X,S(sup 2)) in C(sup infinity)(X,S(sup 2)) for the product X = X(sub 1) x ... x X(sub n). H.A.

N92-21419# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE VEHICLE ROUTING PROBLEM WITH TIME WINDOWS: MINIMIZING ROUTE DURATION
M. W. P. Savelsbergh Jan. 1991 18 p
(Memo-COSOR-91-03; ETN-92-91124) Avail: NTIS HC/MF A03

The implementation of edge exchange improvement methods for the vehicle routing problem with time windows with minimization of route duration as the objective is investigated. The presence of time windows as well as the chosen objective determine that the verification of the feasibility and the profitability of a single edge exchange require an amount of computing time that is linear in the number of vertices. It is shown how the effort can, on the average, be reduced to a constant. ESA

N92-21445 Columbia Univ., New York, NY.
PARALLEL SOLUTION OF INTEGRAL EQUATIONS Ph.D. Thesis
Rajesh Aggarwal 1991 100 p
Avail: Univ. Microfilms Order No. DA9202645

The present research is concerned with computational techniques for the solution of linear and nonlinear integral equations in a multiprocessor environment. Contemporary multi-dimensional and/or nonlinear problems in computational mechanics involve integral equations that can tax the capacity and speed of even the fastest serial computers. Parallel computers offer the possibility of gains in speed almost proportional to the number of processors employed. The degree to which such gains are actually achievable is highly dependent on both the numerical algorithms and the manner in which they are implemented. Conventional numeric techniques have inherent accuracy limitation, are serial in nature, and require substantial synchronization and other special features which seriously degrade their performance in a parallel environment. The present work focuses on the exploitation and implementation of a new class of recently developed computational techniques, known as accelerated projection methods, which are distinctly different from conventional methods, capable of high accuracy and which are particularly appropriate for concurrent computing. It is shown that the accelerated projection methods possess a high degree of parallelism that leads to extremely efficient parallel algorithms. The methods are implemented in detail on multiprocessors for particular linear and nonlinear integral equations of interest in computational mechanics. Dissert. Abstr.

N92-21592# International Centre for Theoretical Physics, Trieste (Italy).
A GENERALIZATION OF F. AND M. RIESZ THEOREM
S. Somasundaram Aug. 1991 9 p
(DE92-614143; IC-91/267) Avail: NTIS HC/MF A02

A generalization of F. and M. Riesz Theorem for almost invariant operators on Homogeneous Banach spaces of compact abelian groups has been shown to be true for almost periodic operators in the case of non-compact abelian groups. DOE

N92-21593# International Centre for Theoretical Physics, Trieste (Italy).
ON THE UNBOUNDED BEHAVIOUR FOR SOME NON-AUTONOMOUS SYSTEMS IN BANACH SPACES
B. DjafariRouhani Sep. 1991 13 p
(DE92-614144; IC-91/285) Avail: NTIS HC/MF A03

By modifying our previous methods and by using the notion of integral solution introduced by Benilan, we study the asymptotic behavior of unbounded trajectories for the quasi-autonomous dissipative system: du/dt + Au is not an element of f where X is a real Banach space, A an accretive (possibly multivalued) operator in X x X, and f - f sub infinity is an element of L sup p ((0, + infinity);X) for some f sub infinity is an element of X and 1 is less than or = p less than infinity. DOE

N92-21599# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
CANONICAL REPRESENTATIVES AND EQUATIONS IN HYPERBOLIC GROUPS
E. Rips and Z. Sela Dec. 1991 23 p Prepared in cooperation with Hebrew Univ., Jerusalem, Israel
(PB92-134428; IHES/M/91/84) Avail: NTIS HC/MF A03
CSCL 12A

Canonical representatives in hyperbolic groups are used to reduce the theory of equations in (torsion free) hyperbolic groups to the theory in free groups. As a result, an effective procedure is given to decide if a system of equations in such groups has a solution. For free groups, the question was solved by Makanin and Razborov. The case of quadratic equations in hyperbolic groups has already been achieved by Lysenok. Author

N92-21600# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
ISOMORPHISM PROBLEM FOR HYPERBOLIC GROUPS AND THE CLASSIFICATION OF 3-MANIFOLDS
Z. Sela Dec. 1991 34 p
(PB92-134436; IHES/M/91/83) Avail: NTIS HC/MF A03
CSCL 12A

Using canonical representatives in hyperbolic groups and the decidability of the Diophantine theory of free semigroups with paired alphabet, the isomorphism problem is solved for hyperbolic groups with no small action on a real tree. The solution enables computation of the outer automorphism group of such groups and implies the homeomorphism problem for 'weakly geometric' 3-manifolds, closed hyperbolic manifolds and negatively curved ones of dimension = or greater than 5. Author

N92-21601# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
LOCAL THEORY OF NORMED SPACES AND ITS APPLICATIONS TO CONVEXITY
J. Lindenstrauss and V. D. Milman Dec. 1991 90 p
(PB92-136365; IHES/M/91/86) Avail: NTIS HC/MF A05
CSCL 12A

The local theory of Banach spaces deals with convex bodies in R(sup n) where n is finite but large. The main theme of the theory is a quantitative study of the structure of such sets and asymptotic estimates of various parameters associated with them as n yields infinity. The theory grew out of, and in a sense can still be considered as a central part of, functional analysis. The main idea in functional analysis is to consider complex elements (say a function or the state of a physical system) as points in a linear space and to study the relation between such objects in analogy to the study of points, lines, planes, etc., in geometry using also an appropriate norm for quantitative estimates. The approach leads naturally in many examples to the study of infinite-dimensional Banach spaces, i.e., geometrically to the study of convex sets in infinite dimensional spaces. The definition of convexity involves only 2-D subspaces of a linear space. Many fundamental facts concerning convex sets in the plane or 3 space generalize in a neat and very useful way to infinite dimension (e.g., the Hahn-Banach or Krein-Milman theorems). These results are responsible for the success of functional analysis. Author

N92-21602# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
SYMPLECTIC DISPLACEMENT ENERGY FOR LAGRANGIAN SUBMANIFOLDS
L. Polterovich Oct. 1991 19 p Sponsored in part by US-Israel Binational Science Foundation
(PB92-136381; IHES/M/91/68) Avail: NTIS HC/MF A03
CSCL 12A

Recently H. Hofer introduced an interesting quantity, so called displacement energy, associated with a subset of symplectic manifold. Roughly speaking, the quantity measures how large a variation of a compactly supported Hamiltonian function must be in order to push the subset away from itself by a time one map of the corresponding Hamiltonian flow. Hofer proved that, at least in the standard symplectic vector space, displacement energy of every open subset is strictly positive. Herein, displacement energy is studied for Lagrangian submanifolds of symplectic manifolds. It is estimated from below through symplectic area class assuming that the symplectic manifold is tame and the Lagrangian submanifold is closed and rational. As a corollary, it is obtained that if symplectic area class of a tame symplectic manifold is rational, then the displacement energy of every open subset is positive. Author

N92-21603# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
NONEXISTENCE OF INVARIANT ANALYTIC HYPOELLIPTIC DIFFERENTIAL OPERATORS ON NILPOTENT GROUPS OF STEP GREATER THAN TWO
M. Christ Oct. 1991 18 p
(PB92-136399; IHES/M/91/71) Avail: NTIS HC/MF A03
CSCL 12A

The development of a large part of the theory of subelliptic partial differential equations has been guided by fundamental papers of Stein and collaborators. These works have pointed the way to a far reaching domain of research centered around the confluence of partial differential equations, complex analysis in several variables, harmonic analysis on Euclidean spaces and on nilpotent groups, and real variables. Further progress is announced in this direction. Detailed proofs appear elsewhere. Four themes are discussed along with the connections between them: Analytic hypoellipticity of subelliptic partial differential operators, especially those which are left invariant and homogeneous on some nilpotent Lie group; Hypoellipticity of certain PDE with complex coefficients, in the C(sup infinity) sense; Certain one parameter families of irreducible representations of nilpotent Lie groups and algebras; and A scattering problem for ordinary differential equations. Author

N92-21604# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
MONODROMY OF POLYGARITHMS AND COSIMPLICIAL SPACES
Z. Wojtkowiak Nov. 1991 34 p
(PB92-136415; IHES/M/91/77) Avail: NTIS HC/MF A03
CSCL 12A

The monodromy representation was studied of iterated integrals on P(sup 1)(c) minus several points. The knowledge of the monodromy of the dilogarithm is essential in the construction of the Bloch-Wigner function D(sub 2) and its higher analogs. These functions play an important role in algebraic K-theory. Among other things, a construction is given of analogs of the Bloch-Wigner function for any iterated integral on P(sub 1)(c) minus several points. Author

N92-21757# Research Inst. of National Defence, Stockholm (Sweden). Dept. of Weapon Systems, Effects and Protection.
HANKEL TRANSFORMATION FOR ANALYSIS OF MODAL STRUCTURES OF WAVE FIELDS IN HORIZONTALLY STRATIFIED MEDIA
K. Oestlund Nov. 1991 40 p In ENGISH; SWEDISH summary
(PB92-129089; FOA-C-20852-2.2) Avail: NTIS HC/MF A03
CSCL 12A

The effects of the environmental parameters on the modal structure of the wave field in a laterally homogeneous fluid-solid medium are studied. The wavenumbers for the sediment modes are indeed sensitive to the shear parameters of the sediment. When experimental data are available, the modal structure can be determined by Hankel transforming the cylindrically symmetric pressure field given as a function of range. The following methods for numerical evaluation of the Hankel transform are described and tested for a known example: the trapezoidal rule, the Fourier-Bessel series, the fast Fourier transform applied on the asymptotic form, the fast Hankel transform, and a particular direct integration method. The two most promising methods, the Fourier-Bessel series and the fast Fourier transform applied on

the asymptotic form, were chosen for evaluation of the Green's function from a simulated hydroacoustic pressure field. Computational results are presented. Author

N92-21765# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.

GRAPH PROPERTIES FOR SPUTTINGS WITH GROUNDED LAPLACIAN MATRICES

U. Miekkala Dec. 1990 18 p

(PB92-133925; RR-A288; ISBN-951-22-0482-7) Avail: NTIS HC/MF A03 CSCL 12A

With any undirected, connected graph G containing no self-loops, one can associate the Laplacian matrix L(G). It is also the (singular) admittance matrix of a resistive network with all conductances taken to be unity. While solving the linear system involved, one of the vertices is grounded, so the coefficient matrix is a principal submatrix of L which is called the grounded Laplacian matrix L sub 1. The iterative solution of such linear systems is considered, using certain regular splittings of L sub 1 and derive an upper bound for the spectral radius of the iteration matrix in terms of the properties of graph G. GRA

N92-21781# Oak Ridge National Lab., TN.

THE WAVE FUNCTION IN MULTIPLE SCATTERING THEORY

W. H. Butler and X.-G. Zhang (Kentucky Univ., Lexington.) 1991 8 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991

(Contract DE-AC05-84OR-21400)

(DE92-005425; CONF-911202-24) Avail: NTIS HC/MF A02

The wave function in Multiple Scattering Theory (MST) is a locally exact solution to the Schroedinger equation for any l truncation (l sub max), except at the muffin-tin boundaries (or cell boundaries in a full cell calculation) where it and its derivative generally have discontinuities. These discontinuities vanish only in the limit (l sub max) yields infinity. Furthermore, the MST wave function as usually calculated is not correctly normalized, which means the density of states calculated from the Green function does not agree with that calculated from the Lloyd formula. Here we obtain an alternative wave function from the usual MST secular equation which is smooth and continuous everywhere and which is correctly normalized. DOE

N92-21783# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.

FOUR-BLOCK MODEL MATCHING PROBLEM IN (l)1

O. J. Staffans 1990 50 p Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg

(PB92-133933; RR-A289; ISBN-951-22-0484-3) Avail: NTIS HC/MF A03 CSCL 12A

Previously, a dual approximation approach was presented to an infinite dimensional linear programming formulation of the discrete time mixed sensitivity l(sup 1) minimization problem. If one combines that approach with an earlier known primal approximation approach developed by Dahleh and Pearson, then one gets good bounds on the approximation error, and it is possible to compute the solution within any specified tolerance. The original purpose was to extend the same approach to the general discrete four block model matching problem. However, it was realized that there are several other questions, related to the general four block l(sup 1) minimization problem, which have either not been addressed at all, or for which only incomplete answers have been given. As a result, it was decided to present a thorough treatment of the complete problem. First, the correct formulation is discussed of the problem as an infinite dimensional linear programming problem in l(sup 1). Two different methods are discussed to solve the infinite dimensional linear programming problem, and a procedure is given that under certain assumptions enables the solution of the system to within any given tolerance. Convergence properties are discussed. Author

N92-21799# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).

ARITHMETICS OF 1-, 2- AND 3-EDGED GROTHENDIECK DESSINS

G. B. Shabat Nov. 1991 18 p

(PB92-136423; IHES/M/91/75) Avail: NTIS HC/MF A03 CSCL 12A

In an unpublished paper, A. Grothendieck established the correspondence between certain graphs on the surfaces and algebraic curves over number fields. Though both classes of objects can be described by finite amounts of information, no general methods of the constructive realization of the correspondence are known. The number of edges of the graph is the natural measure of complexity of the objects considered. Herein, the first complete list is given of results concerning the objects of the lowest complexity. Dessins is short for Grothendieck's dessins d'enfant from his unpublished paper, and is the triples X(0) included in X(1) included in X(2), where X(2) is a compact connected oriented closed topological surface, X(0) is a non-empty finite set, the difference of sets X(1) and X(0) is a disjoint union of open segments and the difference of sets X(2) and X(1) is a disjoint union of open cells. Author

N92-21811# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.

NON-LINEAR EIGENVALUE PROBLEM: STABILITY AND CONCAVITY

P. Lindqvist Jun. 1990 16 p

(PB92-133875; RR-A279; ISBN-951-22-0267-0) Avail: NTIS HC/MF A03 CSCL 12A

The stability with respect to p of the nonlinear eigenvalue problem div((absolute value of del u)exp(p-2) x del u) + lambda (absolute value of u)exp(p-2) x u = 0 is studied. The 'power concavity' of the first eigenfunction is investigated in the radical case. GRA

N92-21812# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.

GLOBAL INTEGRABILITY AND DEGENERATE QUASILINEAR ELLIPTIC EQUATIONS

P. Lindqvist Dec. 1990 14 p

(PB92-133917; RR-A287; ISBN-951-22-0464-9) Avail: NTIS HC/MF A03 CSCL 12A

An integrability phenomenon for elliptic equations in divergence form is studied. It is proven that solutions and supersolutions that are bounded from below are globally integrable to some power. This extends a result known for harmonic functions to a nonlinear situation. BMO-techniques are used. GRA

N92-21813# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).

UNIFORM EMBEDDINGS OF HYPERBOLIC GROUPS IN HILBERT SPACES

Z. Sela Nov. 1991 12 p

(PB92-134386; IHES/M/91/74) Avail: NTIS HC/MF A03 CSCL 12A

Uniform embeddings of the Cayley graphs of hyperbolic groups and cyclic extensions of torsion-free small cancellation groups in Hilbert spaces are constructed. GRA

N92-21821# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mathematics.

WHAT NORM SHOULD ONE USE IN A MIXED SENSITIVITY MINIMIZATION

O. J. Staffans Oct. 1990 18 p

(PB92-133891; ISBN-951-22-0396-0; RR-A283) Avail: NTIS HC/MF A03 CSCL 12A

In the mixed sensitivity minimization problem, one minimizes some weighted combination of the sensitivity function S and the complementary sensitivity function 1-S. Depending on the norm that one uses, one gets different results. In the discrete case, one may use, for instance, an l(infinity)-norm (maximal deviation is minimalized), an l(exp 2)-norm (the energy of the output is

minimized), or an l(exp 1)-norm (the total mass of the output is minimized). Here, the authors concentrate on the l(infinity) and l(exp 1)-cases. The authors show that in these cases there are several competing norms that all make sense. In particular, the solution is sensitive to the interpretation of the problem as a multi input single output problem or as a single input multi output problem. The authors present a number of such norms and investigate how the solution changes with the norm. Author

N92-21835# National Inst. of Standards and Technology, Gaithersburg, MD. Applied and Computational Mathematics Div.
COMPUTING DELAUNAY TRIANGULATIONS FOR COMET-SHAPED POLYGONS
J. Bernal Nov. 1991 19 p
(PB92-123108; NISTIR-4716) Avail: NTIS HC/MF A03 CSCL 12A

The author presents two triangulation algorithms which combined produce an algorithm for computing Delaunay triangulations for comet-shaped polygons. The first algorithm constructs in linear time a triangulation for a comet-shaped polygon. The second algorithm constructs a Delaunay triangulation for a polygon from any triangulation for the polygon. The algorithms can be used for deleting vertices in a Delaunay triangulation and for computing constrained Delaunay triangulations. Author

N92-21843# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mechanics.
SOLVING A PARABOLIC EQUATION BY THE COMBINED DISCONTINUOUS-GALERKIN PETROV-GALERKIN FINITE ELEMENT METHOD
J. Freund 1990 29 p
(PB92-134378; ISBN-951-22-0449-5; Rept-1990/29) Avail: NTIS HC/MF A03 CSCL 12A

The application of the discontinuous-Galerkin Petrov-Galerkin finite element method to the solution of a problem of parabolic type is presented. The starting point is the usual weak form for the convection-diffusion problem in two dimensions. The discontinuous Galerkin method is first used for dimensional reduction purposes: the original problem in 2D is replaced by a series of 1D problems. The Petrov-Galerkin method is then used to solve the resulting system. The formula for a so-called perturbation weighting matrix appearing in the formulation is written as a direct extension of an earlier one. Also a somewhat simplified, more practical selection for the perturbation weighting matrix is given. GRA

N92-21980 Tel-Aviv Univ. (Israel). Dept. of Pure Mathematics.
THE BAYESIAN FORMULATION OF INCOMPLETE INFORMATION: THE NON-COMPACT CASE M.S. Thesis
Aviad Heifetz Aug. 1990 20 p
(ITN-92-85158) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

In a game with incomplete information, a player may have beliefs about 'nature' (= the various parameters of the game), about the other players' beliefs about 'nature', and so on, in an infinite hierarchy. By using a generalized construction, it is shown that if 'nature' is any Hausdorff space, and beliefs are regular Borel probability measures, then the space of all such infinite hierarchies of the players is a product of 'nature' and the types of player, where a type of player is a belief about 'nature' and the other players' types. Author (ISA)

N92-21994# Sheffield Univ. (England). Dept. of Automatic Control and Systems Engineering.
QUALITATIVE ANALYSIS OF CHAOS IN NONLINEAR SAMPLED DATA SYSTEMS AND SYSTEM IDENTIFICATION
B. R. Haynes (Leeds Univ., England) and S. A. Billings Jul. 1991 34 p Sponsored by Science Research Council
(RR-434; ETN-92-90652) Avail: NTIS HC/MF A03

Analysis of nonlinear sampled data systems is considered. A qualitative approach is adopted in which the system is suspended in a parameterized cell state space framework. Application of a global unravelling algorithm reveals the type of behavior typically found using dynamical systems techniques. Steady state, periodic, and aperiodic or chaotic behavior is detected. System identification techniques are then applied. The resulting nonlinear recursive input output model is analyzed within the above framework and is shown to exhibit the same periodic characteristics as the original nonlinear sampled data system. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N92-21166# Pittsburgh Univ., PA. Inst. for Computational Mathematics and Applications.
ON THE THEORY AND ERROR ESTIMATION OF THE REDUCED BASIS METHOD FOR MULTI-PARAMETER PROBLEMS
Werner C. Rheinboldt Jan. 1992 20 p
(Contract N00014-90-J-1025; NSF CCR-89-07654)
(AD-A245201; ICMA-92-167) Avail: NTIS HC/MF A03 CSCL 12/3

In an earlier paper (ZAMM 63, 1983, 21), J. P. Fink and W. C. Rheinboldt developed a priori local error estimates for the scalar-parameter case of the reduced basis method by considering the method in a differential-geometric setting. Here it is shown that an analogous setting can be used for the analysis of the method applied to problems with a multidimensional parameter vector and that this leads to a corresponding local error theory also in this general case. GRA

N92-21239# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
APPROXIMATIONS AND TWO-SAMPLE TESTS BASED ON P-P AND Q-Q PLOTS OF THE KAPLAN-MEIER ESTIMATORS OF LIFETIME DISTRIBUTIONS
Paul Deheuvels (Paris VI Univ., France) and John H. J. Einmahl Jul. 1991 25 p
(Memo-COSOR-91-16; ISSN-0926-4493; ETN-92-91134) Avail: NTIS HC/MF A03

A study concerned with nonparametric comparative statistical inference for survival distributions in the two-sample case is presented. Namely, if F(sub m) and G(sub n) denote Kaplan-Meier estimators of lifetime (or failure) distribution functions based on independent samples of sizes m and n respectively, statistical comparison procedures of the unknown distributions F and G based on F(sub m) and G(sub n) are considered. ESA

N92-21417# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
AN ERROR NOTE ON A GENERATING-FUNCTION ANALYSIS OF MULTIPROGRAMMING QUEUES
I. J. B. F. Adan, J. Wessels, and W. H. M. Zijm (Universiteit Twente, Enschede, Netherlands) Dec. 1990 17 p
(Memo-COSOR-90-47; ETN-92-91122) Avail: NTIS HC/MF A03

Explicit representations for some of the queue length probabilities of a multiprogramming model are derived. These representations have the form of infinite sums of powers. It is demonstrated that these representations are not always correct. It is shown when the representations hold and when they do not hold. ESA

N92-21421# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE CLASSIFICATION CAPABILITIES OF EXACT TWO-LAYERED PERCEPTRONS
P. J. Zwietering, E. H. L. Aarts (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands), and J. Wessels May 1991 22 p
(Memo-COSOR-91-09; ISSN-0926-4493; ETN-92-91129) Avail: NTIS HC/MF A03

The problem of finding a two layered perceptron that exactly classifies a given subset is studied. Such a two layered perceptron is called exact with respect to a given subset. A necessary and a

sufficient condition for a given subset to be classifiable by an exact two layered perceptron is derived. The necessary condition can be viewed as a generalization of the linear separability condition of the one layered perceptron and confirms the conjecture that the capabilities of exact two layered perceptrons are more limited than those of exact three layered perceptrons. The sufficient condition shows that the capabilities of exact two layered perceptron extend beyond the exact classification of convex subsets. A systematic verification method for the given sufficient condition is presented. ESA

N92-21705# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE EFFICIENCY OF SUBSET SELECTION OF AN ALMOST BEST TREATMENT
Paul vanderLaan Aug. 1991 15 p
(Memo-COSOR-91-19; ISSN-0926-4493; ETN-92-91137) Avail: NTIS HC/MF A03

A generalized goal using subset selection is discussed for the location parameter case. This goal is to select a non empty subset from a set of k(k greater than or equal to 2) treatments that contains at least one epsilon best treatment with confidence level P(*). For a set of treatments an epsilon best treatment is defined as a treatment with location parameter on a distance less than or equal to epsilon (epsilon greater than or equal 0) from the best treatment, where best is defined as largest value of the location parameter. The efficiency of subset selection of an epsilon best treatment relative to subset selection of the best treatment is investigated and is computed for the normal case as well as for the logistic case. ESA

N92-21756# Stanford Univ., CA.
COMPUTATIONAL TECHNIQUES FOR PROBABILISTIC INFERENCE
Edward H. Shortliffe and Gregory F. Cooper 30 Nov. 1991 11 p
(Contract DAAL03-88-K-0183)
(AD-A244814; ARO-25514.27-EL) Avail: NTIS HC/MF A03 CSCL 12/3

The development of pragmatic and theoretically sound methods for the computation of probabilistic information within expert systems is discussed. The use of Bayesian belief networks as a probabilistic representation is explored. Several previously described belief-network inference algorithms that perform exact inference were implemented. Additionally, a hybrid algorithm and a new algorithm were developed. The conclusion is that no single algorithm is best for all inference problems. Moreover, further analysis revealed that the belief-network inference problem is NP-hard. Thus, it is unlikely that an exact algorithm that is uniformly efficient (polynomial time) across all networks and inference problems can be developed. This led to the investigation of special-case and approximation algorithms, as well as methods for controlling multiple algorithms in solving a single inference problem. The investigation indicates that moderately complex expert systems based on belief networks can be constructed using these current methods. The development of improved methods for controlling the application of multiple inference algorithms is likely to allow tractable inference in increasingly complex expert systems based on belief networks. The construction of complex belief networks also presents significant challenges. Automated and semi-automated knowledge-acquisition techniques were developed. These techniques show significant promise in preliminary tests. GRA

N92-21995# Leiden Univ. (Netherlands). Dept. of Mathematics and Computer Science.
SEPARABLE MARKOVIAN DECISION PROBLEMS: THE LINEAR PROGRAMMING METHOD IN THE MULTICHAIN CASE
Lodewijk C. M. Kallenberg 1991 23 p
(TW-91-01; ETN-92-90977) Avail: NTIS HC/MF A03

Separable Markovian decision problems have the property that for certain pairs (i,a) of a state i and an action a, the immediate reward is the sum of terms due to the current state and action (r sub ia) s(sub i) + t(sub a) and the transition probability depends only on the action and not on the state from which the transition occurs. The separable model was studied in the late sixties. For the discounted case and the unichain undiscounted case a reduced LP (Linear Programming) formulation was given, which involves a substantially smaller number of variables than in the LP formulation of a general Markov decision problem. It was unknown whether such an efficient formulation was also possible in the multichain case. This problem was solved; such an efficient formulation can be obtained. Some applications of separable models are presented. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N92-21387# Lowell Univ., MA. Dept. of Electrical Engineering.
ON THE ISSUE OF THE BORN-RYTOV CONTROVERSY. 1: COMPARING ANALYTICAL AND APPROXIMATE EXPRESSIONS FOR THE ONE-DIMENSIONAL DETERMINISTIC CASE
F. C. Lin and M. A. Fiddy 1991 32 p
(Contract N00014-89-J-1158)
(AD-A244596) Avail: NTIS HC/MF A03 CSCL 12/2

The applicability and domains of validity for the Born and the Rytov methods in scattering theory are established, with mathematical rigor, by comparing successive terms of the Born and the Rytov series calculated for wave propagation in a homogeneous dielectric halfspace and a homogeneous dielectric slab, for which the permittivities are assumed to have a low contrast over that of free-space. While the (first order) Rytov approximation is superior to the (first order) Born approximation when it is applied to estimate the scattered field in the homogeneous dielectric half-space, both approximations are inapplicable to estimate the scattered fields when the dielectric slab is very thick. There is much interest in modeling the propagation and scattering of waves in inhomogeneous media, to solve both direct and inverse scattering problems. The physical properties of these media can be extracted or predicted from the measurable quantities such as the scattered fields and intensities which can be derived from the models. Usually, approximations are sought in order to make the scattered fields (which can be expressed as the Fredholm integral equations of the first kind) more tractable for numerical computation. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N92-22088*# General Electric Co., Moorestown, NJ. Government Electronic Systems Div.
THE HAMILTONIAN STRUCTURE OF DIRAC'S EQUATION IN TENSOR FORM AND ITS FERMI QUANTIZATION
Frank Reifler and Randall Morris *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 381-383 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 12A

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N92-21123# Wisconsin Univ., Madison.
LOCALIZED-ITINERANT MAGNETISM: THIN FILMS AND HETEROSTRUCTURES

1991 17 p
(Contract DE-FG02-87ER-45319)
(DE92-007580; DOE/ER-45319/3) Avail: NTIS HC/MF A03

This report concentrates on the several accomplishments of the past twelve months. Of the 13 manuscripts discussed in last year's report, 11 have been accepted for publication or are in print; the other two are still in preparation. Further, we have submitted 11 new manuscripts, of which 7 have been accepted or are in print, and have 7 new manuscripts in preparation. This report includes a detailed discussion of our scientific accomplishments (section one), our proposed work (section two) and a justification of our proposed budget (section three). Our accomplishments include a theoretical analysis of layer-layer magnetic coupling, applied to paramagnetic ferromagnetic, ferromagnetic ferromagnetic, and diamagnetic ferromagnetic systems. We have made several discoveries using the Gd(0001) overlayer system. These include a greater understanding of the 5d electron-5p hole coupling, a surface state and bulk features intimately related to a most unusual magnetic coupling between surface and bulk and changes with temperature of both the surface and bulk electronic features. Further, we have developed two new methods for fabricating magnetic multilayers. DOE

N92-21706# National Academy of Sciences - National Research Council, Washington, DC. Committee on Atomic, Molecular, and Optical Sciences (CAMOS).
RESEARCH BRIEFING ON SELECTED OPPORTUNITIES IN ATOMIC, MOLECULAR, AND OPTICAL SCIENCES
1991 21 p
(Contract DE-FG05-85ER-13326; NSF PHY-89-21799)
(DE92-007813; DOE/ER-13326/T3) Avail: NTIS HC/MF A03

This report discusses research on the following topics: The Laser-Atom Revolution; Controlling Dynamical Pathways; Nonclassical States of Light; Transient States of Atomic Systems; New Light Generation and Handling; Clusters; Atomic Physics at User Facilities; and Impacts of AMO Sciences on Modern Technologies. DOE

N92-21804# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.
EXACT IMAGE THEORY: A SUMMARY OF RESEARCH
I. V. Lindell Aug. 1990 91 p
(PB92-128446; ISBN-951-22-035; Rept-70) Avail: NTIS HC/MF A05 CSCL 20C

An attempt is made to give systematic coverage to a discipline called the Exact Image Theory (EIT), based on research by the author and his colleagues since 1983. The EIT is given in a general form applicable to layered media with plane parallel interfaces. Specific geometries are presented as special cases of the general formulation. Author

N92-21816# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
ACCURACY OF A GAUSSIAN BEAM
J. Tuovinen Apr. 1991 22 p
(PB92-12166; ISBN-951-22-0588-2; S-190) Avail: NTIS HC/MF A03 CSCL 20C

The accuracy of a multimode Gaussian beam is discussed. Modifications are given to the conventional Gaussian beam formulation derived using the paraxial approximation. With the modifications, the field can be calculated accurately with the Gaussian beam. Modified multimode Gaussian beam techniques are used for calculation of the beam of a corrugated horn. Phase and amplitude patterns given by the method are compared with the measurements and other theoretical methods, namely Huygens' principle and modal matching technique. The meaning of the phase and phase center is also discussed. Author

N92-21842# Helsinki Univ. of Technology, Espoo (Finland). Inst. of Mechanics.
NOTES ON PETROV-GALERKIN WEIGHTING FUNCTIONS IN CONNECTION WITH THE SCALAR CONVECTION-DIFFUSION EQUATION
J. Freund and E. M. Salonen 1990 42 p
(PB92-134360; ISBN-951-22-0448-7; Rept-1990/28) Avail: NTIS HC/MF A03 CSCL 20C

The finite element method for convection-diffusion boundary value problems in one and two dimensions is discussed. The primary goal is to obtain a method giving accurate nodal values. The other purpose is didactic: the authors try to proceed in a way that very little prior knowledge about the subject is needed to understand the lines of thought. The one- and two-dimensional cases are treated separately. In both cases the appropriate weak form is derived starting from the boundary value problem in its strong form. In contrary to the usual treatment, the outcome of the manipulations is not only the weak form but, in addition, detailed information about the appropriate weighting functions is given. The general one-dimensional case is treated first and a method which could be labelled as a conforming one is obtained. The two-dimensional case turns out to be much more difficult; at least in practice. However, the authors suggest some possible approximate procedures as starting points for further studies. Finally some numerical results are given in the one- and two-dimensional cases. The results are compared with the ones obtained by the Galerkin, the Galerkin Gradient Least Squares (GGLS), and the streamline upwind/Petrov-Galerkin (SUPG) methods. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N92-21173*# McDonnell-Douglas Helicopter Co., Mesa, AZ.
BLADE-MOUNTED TRAILING EDGE FLAP CONTROL FOR BVI NOISE REDUCTION Final Report
A. A. Hassan, B. D. Charles, H. Tadghighi, and L. N. Sankar (Georgia Inst. of Tech., Atlanta.) Washington Feb. 1992 208 p
(Contract NAS1-19136)
(NASA-CR-4426; NAS 1.26:4426) Avail: NTIS HC/MF A10 CSCL 20A

Numerical procedures based on the 2-D and 3-D full potential equations and the 2-D Navier-Stokes equations were developed to study the effects of leading and trailing edge flap motions on the aerodynamics of parallel airfoil-vortex interactions and on the aerodynamics and acoustics of the more general self-generated rotor blade vortex interactions (BVI). For subcritical interactions, the 2-D results indicate that the trailing edge flap can be used to alleviate the impulsive loads experienced by the airfoil. For supercritical interactions, the results show the necessity of using a leading edge flap, rather than a trailing edge flap, to alleviate the interaction. Results for various time dependent flap motions and their effect on the predicted temporal sectional loads, differential pressures, and the free vortex trajectories are presented. For the OLS model rotor, contours of a BVI noise metric were used to quantify the effects of the trailing edge flap on the size and directivity of the high/low intensity noise region(s). Average reductions in the BVI noise levels on the order of 5 dB with moderate power penalties on the order of 18 pct. for a four bladed rotor and 58 pct. for a two bladed rotor were obtained. Author

N92-21197# Sandia National Labs., Albuquerque, NM.
PORTABLE ACOUSTIC WAVE SENSOR SYSTEMS
G. C. Frye, S. J. Martin, R. W. Cernosek, K. B. Pfeifer, and J. S. Anderson 1991 6 p Presented at the IEEE Ultrasonics Symposium, Lake Buena Vista, FL, 8-11 Dec. 1991
(Contract DE-AC04-76DP-00789)
(DE92-007043; SAND-91-1679C; CONF-911220-3) Avail: NTIS HC/MF A02

We have recently demonstrated that two independent responses, wave velocity and wave attenuation, can be obtained from surface acoustic wave (SAW) devices coated with viscoelastic polymers. This independence is observed by plotting the attenuation response vs. the velocity response upon challenging the sensor with a variety of chemicals over a range of concentrations. In this

plot, a unique locus of curves is generated for each chemical species with position along the curve being determined by the species concentration. This dual response enables species identification and concentration determination with a single sensor. To demonstrate the utility of these dual output sensors for real-time industrial monitoring, a portable acoustic wave sensor (PAWS) system is being developed. Tests of this system using polymer-coated SAW devices show rapid, reversible detection of gas phase species, rapid reestablishment of sensor baseline using an activated carbon scrubber, and discrimination of species based on a comparison of the attenuation and velocity responses.
DOE

N92-21237# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AERODYNAMICALLY GENERATED ACOUSTIC RESONANCE IN A PIPE WITH ANNULAR FLOW ENLARGEMENTS AND RESTRICTORS
A. K. Stubos, E. Palli, C. Benocci, and D. Olivari Sep. 1991 40 p Sponsored by BPD
(VKI-TN-178; ETN-92-91062) Avail: NTIS HC/MF A03

The coupling between fluid dynamic instabilities and an acoustic field for the case of flow within a pipe with annular restrictions is studied. It is found that two different behaviors may exist, depending on the distance between restrictors, and that the fluid flow can amplify the acoustic perturbations at the frequencies of the acoustic modes when the two restrictors are close enough. A physical explanation is proposed, linking the amplificiation of an acoustic perturbation to the phase and frequency of vortex shedding from the restrictors, and a general predictive model is found giving the critical Strouhal number of the phenomenon for any height of restrictor.
ESA

N92-21365# Woods Hole Oceanographic Inst., MA.
ACOUSTIC WAVE SCATTERING FROM A RANDOM OCEAN BOTTOM Ph.D. Thesis
Dajun Tang Jun. 1991 134 p
(Contract N00014-86-C-0338)
(AD-A244695; WHOI-91-25) Avail: NTIS HC/MF A07 CSCL 20/1

This thesis investigates low frequency acoustic wave scattering from the ocean bottom. The first part models the ocean bottom as a fluid medium where sound speed and density are constants except a layer in which the density is still a constant, but the sound speed is composed of a large constant and superimposed with a small random component. In the second part, a integro-differential equation method is used to calculate the scattering from the random layer. Emphasis is put on the study of the spatial correlation of the scattered field. The third part concerns the influence of the bottom roughness. A small roughness is added to the water/bottom interface and perturbation method is used to calculate the scattering from the roughness. Under the assumption that the roughness and volume inhomogeneity are uncorrelated, comparisons are made on the scattering strengths between roughness scattering and volume scattering, and the spatial correlation of the total scattered field is evaluated. In the fourth part, the classical definition of the bottom scattering cross section is questioned, and a new set of parameters, the Scattering Correlation Coefficient, is introduced, which does not have the ambiguities associated with the conventional notion of the scattering cross section.
GRA

N92-21423 Georgia Inst. of Tech., Atlanta.
LASER DETECTION OF SOUND Ph.D. Thesis
Joseph F. Vignola 1991 220 p
Avail: Univ. Microfilms Order No. DA9206115

A prototype laser Doppler anemometry (LDA) system has been constructed to detect and measure underwater sound. The technique is based on measuring the Doppler shift of laser light scattered from small particles in colloidal suspension in water. These particles move with the sound wave and thus a measure of their velocity is a measure of the acoustic particle velocity. Experiments have been conducted using this system to measure the acoustic particle displacements in a standing wave tube. A study has been made from both theoretical and experimental perspectives of the performance characteristics and practical limitations of making such measurements. A computer simulation was used to study the effects of physical parameters of the prototype system such as laser power, system geometry, and particle size. Because several authors have suggested that Brownian motion of the scattering particle might limit the system's ability to make such measurements, particular interest has been focused on this question. It has been shown both experimentally and theoretically that Brownian motion does not limit the ability to measure acoustic particle velocity. The emphasis on practical consideration will lead to the development of a laboratory tool that can be used to make non-invasive measurements that can not be made with conventional types of pressure sensors such as a conventional microscope or hydroplane. Examples of such situations are the sound field in the vicinity of a radiating body where there is no simple relationship between acoustic pressure and acoustic particle velocity and sound velocity measurements near an air-water interface.
Author

N92-21442 Delaware Univ., Newark.
THE EFFECTS OF GEOMETRY ON ACOUSTIC AND ELECTROMAGNETIC RESONANCES IN A SPHERICAL CAVITY Ph.D. Thesis
Carol Anne Oxborrow 1990 206 p
Avail: Univ. Microfilms Order No. DA9206323

Recent precision measurements of the speed of sound in gases have been performed using acoustic radial modes in spherical cavities. Most of the experimental uncertainty arises from the determination of the resonator's volume. If the ratio of the speed of sound to the speed of light in the cavity is measured, using electric and acoustic modes, the volume measurement becomes unnecessary. However, the simplest electrical modes are triply degenerate with resonance frequencies dependent to first order on the cavity shape, unlike the radial mode frequencies which are determined by its mean radius. In this work, the effect of artificial deformation of a fabricated spherical cavity on the triply degenerate electric and acoustic modes was studied by adding metal shims between the two halves of the fabricated sphere. Behavior of the acoustic radial modes and the effect of electromagnetic probe insertion was studied. Our data show that almost all frequency splitting of both the acoustic and electrical triplets can be described using two deformations: lengthening or shortening of the cavity and offset of its two parts. We also found three component orientations of the epsilon(sub 11) triplet and demonstrated that these depend mainly on the geometry of the cavity, and also on the coupling of the probes used to make the measurements. Mode orientation can be predicted once the cavity of deformation has been found from the splitting, and our results are in good agreement with these predictions. We have also demonstrated that acoustic radial mode dispersion is of about the same order as that predicted by theory, though consistently smaller. This agrees with previous findings that the dispersion is smaller than expected. We conclude that a theoretical model is required which links coupling and perturbation of the probes with the geometric deformation of the sphere, so that the effect of these probes can be determined from all three components of the degenerate modes.
Dissert. Abstr.

N92-21443 Georgia Inst. of Tech., Atlanta.
ANALYTICAL AND NUMERICAL APPROACHES FOR FINITE AMPLITUDE SOUND BEAMS RADIATED FROM A CIRCULAR BAFFLED PISTON Ph.D. Thesis
Gee-Pinn James Too 1991 156 p
Avail: Univ. Microfilms Order No. DA9206113

Finite amplitude sound beams have been studied in the past using a variety of analytical and numerical approaches. Each approach contains certain approximations that restrict the generality of the application to a limited spatial domain or frequency range. In addition, most existing models are based on a frequency domain representation, which cannot fully describe the propagation of the transient pulses often generated in practice. In the present study,

the finite amplitude sound beams problem is attacked by two approaches. One is to explore improvements in analysis, using the King integral in combination with perturbation methods. The other is to develop new time domain numerical models based on McDonald and Kuperman's Nonlinear Progressive Equation (NPE) approach. These models are based on spherical and cylindrical coordinate versions of NPE. The goal of the present studies is to achieve an overall description of finite amplitude sound beams, that is suitable for pulsed, as well as continuous wave excitations. In addition, the spherical version of NPE, which is suitable for axisymmetric converging and diverging waves, is used to simulate a focused sound beam. Also, the modified NPE is applied to bifrequency excitation in order to explore the backward sloping wave phenomena which are the delay of shock distance and enhancement of farfield fundamental due to the existence of second harmonic with a certain phase shift on a projector face. Dissert. Abstr.

N92-21458*# Lockheed Engineering and Sciences Co., Hampton, VA.

COMPUTATIONAL METHODS IN THE PREDICTION OF ADVANCED SUBSONIC AND SUPERSONIC PROPELLER INDUCED NOISE: ASSPIN USERS' MANUAL

M. H. Dunn and G. M. Tarkenton Washington NASA. Langley Research Center Apr. 1992 44 p
(Contract NAS1-19000)
(NASA-CR-4434; NAS 1.26:4434) Avail: NTIS HC/MF A03 CSCL 20A

This document describes the computational aspects of propeller noise prediction in the time domain and the use of high speed propeller noise prediction program ASSPIN (Advanced Subsonic and Supersonic Propeller Induced Noise). These formulations are valid in both the near and far fields. Two formulations are utilized by ASSPIN: (1) one is used for subsonic portions of the propeller blade; and (2) the second is used for transonic and supersonic regions on the blade. Switching between the two formulations is done automatically. ASSPIN incorporates advanced blade geometry and surface pressure modelling, adaptive observer time grid strategies, and contains enhanced numerical algorithms that result in reduced computational time. In addition, the ability to treat the nonaxial inflow case has been included. H.A.

N92-21719# Aerospace Medical Research Labs., Brooks AFB, TX.

SONIC BOOMS PRODUCED BY US AIR FORCE AND US NAVY AIRCRAFT: MEASURED DATA Final Report, Jul. 1987 - Dec. 1990

R. A. Lee and J. M. Downing Jan. 1991 318 p
(AF Proj. 7231)
(AD-A244804; AL-TR-1991-0099) Avail: NTIS HC/MF A14 CSCL 20/1

A sonic measurement program was conducted at Edwards Air Force Base. Sonic boom signatures, produced by F-4, F-14, F-15, F-16, F-18, F-111, SR-71, and T-38 aircraft, were obtained under the flight track and at various lateral sites which were located up to 18 miles off-track. Thirteen monitors developed by Det 1 AL/BBE were used to collect full sonic boom waveforms, and nine modified dosimeters were used to collect supplemental peak overpressures and the C-weighted Sound Exposure Levels (CSEL) for 43 near steady supersonic flights of the above United States Air Force and United States Navy aircraft. This report describes the measured database (BOOMFILE) that contains sonic boom signatures and overpressures, aircraft tracking, and local weather data. These measured data highlight the major influences on sonic boom propagation and generation. The data from this study show that a constant offset of 26 from the peak overpressure expressed in dB gives a good estimate of the CSEL of a sonic boom. GRA

N92-21736# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.

PREDICTION OF HELICOPTER NOISE: ADAPTATION OF NOISE LOAD CALCULATIONS TO THE BLADE-VORTEX INTERACTION Summary Report [PREVISION DU BRUIT DES HELICOPTERES: ADAPTATION DU CALCUL DE BRUIT DE CHARGE A L'INTERACTION PALE-TOURBILLON. RAPPORT DE SYNTHESE]

P. Spiegel Jan. 1991 45 p In FRENCH
(Contract DRET-89-001-118)
(ONERA-RS-97/5094-PY; ETN-92-90872) Avail: NTIS HC/MF A03

The techniques used in predicting the noise produced by turbine motor helicopters are reviewed. Prediction of the noise produced by the interaction of the main rotor blades and the air vortex is given particular attention. The predictions are made based on pressure values generated by the DIPTEST simulation program. The quality of aerodynamic data required to carry out any acoustic calculations using the DIPTEST program, is defined. Smoothing of pressure coefficients allows a clean acoustic signal to be obtained, which faithfully reflects the physics involved in the phenomenon. ESA

N92-21773# Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.

WAVE ACOUSTICS FOR PROPAGATION OF ULTRASOUND ALONG A VORTEX ARRAY IN SUPERFLUID He-3

E. B. Sonin, K. Torizuka, J. M. Kyynaeraeinen, J. P. Pekola, and G. K. Tvalashvili 22 Apr. 1991 31 p Prepared in cooperation with Akademiya Nauk Gruzinskoi SSR, Tiflis
(PB92-134147; TKK-F-A684; ISBN-951-22-0607-2) Avail: NTIS HC/MF A03 CSCL 20A

A wave-acoustics theory was developed to describe the propagation of zero sound parallel to vortex lines in rotating He-3. It is shown that diffraction 'shadow' is formed in which the wave amplitude is suppressed by interference around vortices. The phenomenon contributes to the experimentally observed effect of rotation on the sound amplitude and exceeds the attenuation at large core radii. The dependence of the diffraction contribution on the angular velocity changes drastically at the transition from vortices with a finite core to coreless vortices when the magnetic field is decreased to zero. Conditions for the applicability of the classical geometrical acoustic method in describing zero sound propagation in a vortex array are derived. GRA

N92-21871# National Inst. of Standards and Technology, Gaithersburg, MD.

RESPONSE OF PERSONAL NOISE DOSIMETERS TO CONTINUOUS AND IMPULSE-LIKE SIGNALS Final Report

D. J. Evans, D. R. Flynn, V. Nedzelnitsky, and E. D. Burnett Jun. 1991 148 p Sponsored in part by Occupational Safety and Health Administration, Washington, DC
(PB92-116359; NIST/TN-1286) Avail: NTIS HC/MF A07; also available SOD HC $9.00 as 003-003-03116-0 CSCL 20A

A study of the capabilities of noise dosimeters to measure personal exposure to time varying and impulse-like noises was carried out. Ten commercial noise dosimeters were obtained. A laboratory reference noise dosimeter was constructed to provide a demonstrably accurate basis with which to compare the commercial noise dosimeters. Each commercial dosimeter, when ordered from the manufacturer, was specified to have a threshold A-weighted sound level of 80 dB, a criterion sound level of 90 dB, and an exchange rate of 5 dB and/or 3 dB. The performance of the commercial dosimeters was compared with theory and with results obtained from the reference dosimeter. Except in a few isolated cases, the commercial dosimeters were in general agreement with the performance specification of the appropriate American National Standard and with the Occupational Safety and Health Administration (OSHA) regulations. Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N92-21107# Valparaiso Univ., IN. Dept. of Physics and Astronomy.
HIGH SENSITIVITY TESTS OF THE STANDARD MODEL FOR ELECTROWEAK INTERACTIONS
D. D. Koetke 1992 10 p
(Contract DE-FG02-88ER-40416)
(DE92-007537; DOE/ER-40416/4) Avail: NTIS HC/MF A02

The work done on this project was focussed mainly on LAMPF experiment E969 known as the MEGA experiment, a high sensitivity search for the lepton family number violating decay mu yields e(gamma) to a sensitivity which, measured in terms of the branching ratio, BR = (mu yields e(gamma))/(mu yields e(nu)(sub mu)nu(sub e)) approximately 10(exp -13) is over two orders of magnitude better than previously reported values. The work done on MEGA during this period was divided between that done at Valparaiso University and that done at LAMPF. In addition, some contributions were made to a proposal to the LAMPF PAC to perform a precision measurement of the Michel rho parameter. DOE

N92-21110# Melbourne Univ., Parkville (Australia). School of Physics.
UNCOVERING THE HIDDEN MECHANICAL MOMENTUM
John Costella 1991 4 p
(DE92-612004; UM-P-91/16) Avail: NTIS HC/MF A01

A number of authors have invoked the concept of a hidden mechanical momentum in the solution of classical electrodynamical problems. In particular, Aharonov, Pearle and Vaidman have argued that its inclusion negates the classical analysis of the Aharonov-Casher effect undertaken by Boyer. In this paper, the true nature of this momentum is uncovered, and the refutation of the Boyer analysis investigated. DOE

N92-21111# Melbourne Univ., Parkville (Australia). School of Physics.
RECIPROCITY IN ELECTRON DIFFRACTION
J. Gunning and P. Goodman 1991 13 p
(DE92-612005; UM-P-91/55) Avail: NTIS HC/MF A03

The symmetry of reciprocity is reviewed in the context of relativistic quantum mechanics with the specific aim of relating to P-C-T invariances. From this investigation global time reversal is found to be a sufficient condition for reciprocity to hold in scattering from a vector potential. Elastic scattering is assumed. The paper also deals exclusively with the scattering of a charged particle by an electromagnetic field. The present proof is free from assumptions of small angle scattering and from restrictions on z-dependent terms in the scattering equation, and by avoiding S-matrix theory, is thought to be accessible to undergraduate teaching. DOE

N92-21128# Melbourne Univ., Parkville (Australia). School of Physics.
DETERMINATION OF F-SPIN SYMMETRY IN DEFORMED NUCLEI
J. N. Ginocchio (Los Alamos National Lab., NM.) and S. Kuyucak 1991 9 p
(DE92-612085; UM-P-91/85) Avail: NTIS HC/MF A02

The purity of a neutron-proton symmetry called F-spin is estimated in collective nuclei. Two simple formulae are shown to provide a quick and accurate estimate for F-spin admixtures in the ground band. Conclusions are also drawn about quadrupole effective charges in collective nuciei. DOE

N92-21129# Melbourne Univ., Parkville (Australia). School of Physics.
GAMMA-UNSTABLE NUCLEI IN THE sdg BOSON MODEL
S. Kuyucak, V-S. Lac, I. Morrison, and B. R. Barret 1991 14 p
(DE92-612105; UM-P-91/28) Avail: NTIS HC/MF A03

Following the recent Pt(p,p') experiments which indicated the need for high angular momentum (g) bosons to reproduce the E4 data, we have extended the O(6) limit of the sd boson model to the sdg bosons. It is shown that a gamma-unstable Hamiltonian in the sdg model consisting of a quadrupole interaction and a g boson energy leads to results that are very similar to the O(6) limit. Deviations from the empirical energy spectrum that stem from the gamma-unstable nature of the Hamiltonian can be improved by including a consistent hexadecapole interaction which induces triaxiality. The same hexadecapole operator can also account for the strong E4 transitions to the 4(sup +) states presumed to be g boson states. Specific applications are made to the Xe and Pt isotopes. DOE

N92-21204# Ohio Univ., Athens. Dept. of Physics and Astronomy.
THEORY OF PHOTON AND ELECTRON INDUCED REACTIONS
D. S. Onley and L. E. Wright Jan. 1992 7 p
(Contract DE-FG02-87ER-40370)
(DE92-007543; DOE/ER-40370/4) Avail: NTIS HC/MF A02

During the first year and a half of the current grant from the Department of Energy, we have made considerable progress on the following aspects of the general investigation of electron and photon induced reactions: (1) photo- and electro-production of mesons; (2) Coulomb distortion effects on (e,e prime gamma) and (e,e prime) and (e,e prime p) in the quasi-elastic region; (3) studies involving the relativistic shell model; and (4) quark models. We will report on each of these developments in this paper. DOE

N92-21206# College of William and Mary, Williamsburg, VA. Dept. of Physics.
NEGATIVE ION DETACHMENT CROSS SECTIONS
R. L. Champion and L. D. Doverspike Dec. 1991 5 p
(Contract DE-FG05-88ER-13874)
(DE92-007709; DOE/ER-13874/4) Avail: NTIS HC/MF A01

During the past year, we have measured cross sections for associative and collisional detachment for several negative ions in collisions with atomic hydrogen. Additional experiments have been performed in which the formation of secondary negative ions and electrons by means of low energy ion impact on surfaces has been studied. Brief descriptions of these activities along with future plans for the project follow. DOE

N92-21220# Lawrence Livermore National Lab., CA.
HARTREE-FOCK DESCRIPTION OF SUPERDEFORMED STATES
J. Dobaczewski, P. Bonche, and H. Flocard (Paris XI Univ., Orsay, France) Oct. 1991 14 p Presented at the 22nd International Summer School on Nuclear Physics, Piaski (Poland), Jun. 1991
(Contract W-7405-eng-48)
(DE92-006899; UCRL-JC-108681; CONF-9106326-1) Avail: NTIS HC/MF A03

The discovery of superdeformation has been preceded by theoretical predictions made in Nilsson-Strutinsky calculations and a description of the phenomenon still constitutes an exciting challenge to the theory of nuclear collective motion. In particular, a determination of electromagnetic transition rates requires a knowledge of microscopic collective wave functions, which can be achieved by using the Hartree-Fock (HF) theory and the generator coordinate method (GCM). In this study we present results of our calculations concerning the properties and superdeformed states in the mercury region. Using the GCM, we diagonalize the microscopic two-body hamiltonian within the basis set of constrained HF + BCS (Bardeen-Cooper-Schrieffer Theory) wave functions. The GCM provides values for the energy of the ground and excited states including the shape isomer which take into account the effect of correlations in the collective degree of freedom. The GCM will also allow us to discuss the qualitative modifications of the shape isomeric stability as induced by changes in pairing correlations. DOE

N92-21229# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
PHOTOELECTRONS-PHOTOIONS COINCIDENCE SPECTROSCOPY FOR VAN DER WAAL CLUSTERS USING SYNCHROTRON LIGHT Ph.D. Thesis [PHOTOELEKTRONEN-PHOTOIONEN KOINZIDENZ-SPEKTROSKOPIE AN VAN DER WAALS CLUSTERN MIT SYNCHROTRONLICHT]
Martin Fieber 1991 87 p In GERMAN; ENGLISH summary
(ETN-92-91002) Avail: NTIS HC/MF A05

Photoionization and the fragmentation processes of van der Waal clusters were studied in order to obtain information on their electronic states and configurations. Time of flight spectra were obtained using the Threshold Electron Photon Ion Coincidence (TEPICO) method. Experiments on Fe(CO)5 are discussed. It is shown that most of the energy deposited in the molecule after photoionization is converted into vibrational energy of the CO. An enrichment of the Ne-22 isotope, in the cluster, of about thirty percent was found, resulting from a photon induced fragmentation. The experimentally obtained magic number could be rationalized by a Diatonics In Molecules (DIM) calculation. ESA

N92-21254# Rutherford Appleton Lab., Chilton (England).
MEASUREMENT OF THE ATTENUATION OF 1 MeV NEUTRONS BY 10 cm OF POLYTHENE
M. Edwards 1 Sep. 1991 16 p
(RAL-91-066; ETN-92-90758) Copyright Avail: NTIS HC/MF A03

The neutron radiation hardness test facility was used to measure the attenuation of '1 MeV' neutrons by a 10 cm thick block of polythene. The measurements made are detailed. Regarding the '1 MeV' neutrons, the polythene is shown to appear to have little effect in the energy spectrum. A high degree of consistency between the expected and measured fluxes for set A, below the polythene, and a high degree of consistency between the two measurements of the flux above the polythene, sets B and C, are shown. The effect of the 10 cm of polythene on the flux is to reduce it by a factor 0.465 plus/minus 0.020. The error quoted is based on the measured consistency of many irradiations performed over the past year. Regarding the 'thermal' neutrons, the 10 cm block of polythene seems to generate a very large flux of neutrons with energy below 10 keV. The flux immediately below the polythene is a factor of 46 greater than would have been expected in the absence of the polythene. Immediately above the polythene the factor is 18, while 10 cm further it is only 5. ESA

N92-21299# Rutherford Appleton Lab., Chilton (England).
PARTON DISTRIBUTIONS FOR THE PION EXTRACTED FROM DRELL-YAN AND PROMPT PHOTON EXPERIMENTS
P. J. Sutton, A. D. Martin, R. G. Roberts, and W. J. Stirling (Durham Univ., England) Aug. 1991 34 p Sponsored in part by Science Research Council
(RAL-91-058; DTP/91/46; ETN-92-90757) Copyright Avail: NTIS HC/MF A03

The parton distributions of the pion from a consistent next to leading order analysis of several high statistics pi plus or minus N experiments including both Drell-Yan and prompt photon production are determined. Three sets of parton distributions of the pion, which span the ambiguity in the sea, are available as a FORTRAN package in the form of (x, Q squared) grids, together with an interpolation routine. These are evolved (to next to leading order) from initial distributions given by the parameters and correspond to sea quark distributions carrying 10, 15, and 20 percent of the momentum of the pion; the central set is the optimum solution. The pion distributions are useful for future fixed target physics pion beams and for (vector) meason dominance applications. The results are noted to be consistent with the quantum chromodynamic lattice computations of the pion distributions. ESA

N92-21363# Washington State Univ., Pullman. Dept. of Chemistry.
DYNAMICS OF AN M-LEVEL ATOM INTERACTING WITH CAVITY FIELDS. 3: NONCLASSICAL BEHAVIOR OF THE INITIALLY SQUEEZED FIELD
Fu-Li Li, Xiao-Shen Li, D. L. Lin, and Thomas F. George Jan. 1992 22 p
(Contract N00014-90-J-1193)
(AD-A244692; WSU/DC/92/TR-75) Avail: NTIS HC/MF A03 CSCL 20/5

The interaction of an M-level atom with a single-mode of cavity field initially in a squeezed state is investigated in this paper. The time evolution of nonclassical characteristics of the field, such as the field squeezing, antibunching and sub-Poisson distribution, are computed and discussed in detail. It is found that the initial coherent excitation strength has crucial influence on how such nonclassical behavior can be maintained in the propagation of squeezed light. GRA

N92-21380# Washington State Univ., Pullman. Dept. of Chemistry.
EFFECTS OF ELECTRON-INTERFACE-PHONON INTERACTIONS ON MAGNETOPOLARONIC IMPURITY TRANSITIONS IN QUANTUM WELLS
R. Chen, D. L. Lin, and Thomas F. George Jan. 1992 14 p
(Contract N00014-90-J-1193)
(AD-A244698; WSU/DC/92/TR-74) Avail: NTIS HC/MF A03 CSCL 20/5

Electron interactions with interface phonon modes and strictly-confined bulk phonon modes are considered for the first time to calculate the magnetopolaronic effect on the transition energy of a hydrogenic impurity in the quantum well of a double heterostructure. The electron-phonon interaction is treated as a perturbation on a hydrogenic impurity confined in a quantum well under strong magnetic fields. The unperturbed states are obtained by the variational method with trial wave functions constructed on symmetry considerations. It is found that the transition energy, as a function of the applied magnetic field, breaks up into three branches with two interaction gaps occurring at two-level and three-level resonances. The lowest branch lies below the bulk TO energy. These results are found in good agreement with recent experimental data. GRA

N92-21401*# Eloret Corp., Palo Alto, CA.
AN AB INITIO STUDY OF THE C3(+) CATION USING MULTIREFERENCE METHODS
Peter R. Taylor, J. M. L. Martin, J. P. Francois, and R. Gijbels (Limburgs Univ., Diepenbeek, Belgium) 1991 19 p Prepared in cooperation with Antwerp Univ. (Belgium)
(Contract NCC2-371)
(NASA-CR-189026; NAS 1.26:189026) Avail: NTIS HC/MF A03 CSCL 20H

The energy difference between the linear 2 sigma(sup +, sub u) and cyclic 2B(sub 2) structures of C3(+) has been investigated using large (5s3p2d1f) basis sets and multireference electron correlation treatments, including complete active space self consistent fields (CASSCF), multireference configuration interaction (MRCI), and averaged coupled-pair functional (ACPF) methods, as well as the single-reference quadratic configuration interaction (QCISD(T)) method. Our best estimate, including a correction for basis set incompleteness, is that the linear form lies above the cyclic from by 5.2(+1.5 to -1.0) kcal/mol. The 2 sigma(sup +, sub u) state is probably not a transition state, but a local minimum. Reliable computation of the cyclic/linear energy difference in C3(+) is extremely demanding of the electron correlation treatment used: of the single-reference methods previously considered, CCSD(T) and QCISD(T) perform best. The MRCI + Q(0.01)/(4s2p1d) energy separation of 1.68 kcal/mol should provide a comparison standard for other electron correlation methods applied to this system. Author

N92-21466# National Inst. of Standards and Technology, Gaithersburg, MD. Ionizing Radiation Div.
MASS ENERGY-TRANSFER AND MASS ENERGY-ABSORPTION COEFFICIENTS, INCLUDING IN-FLIGHT POSITRON ANNIHILATION FOR PHOTON ENERGIES 1 keV TO 100 MeV
P. D. Higgins, F. H. Attix, J. H. Hubbell, S. M. Seltzer and M. J. Berger Nov. 1991 70 p Prepared in cooperation with Cleveland Clinic Foundation, OH, and Wisconsin Univ., Madison
(PB92-126473; NISTIR-4680) Avail: NTIS HC/MF A04 CSCL 20H

Mass energy transfer (Mu sub u Rho) and mass energy absorption coefficients (Mu sub en Rho) are tabulated in units of sq. cm/g for photon energies between 1 keV and 100 MeV for 29 elements (Z = 1-92), and 14 mixtures and compounds of general dosimetric interest. Cross sections for photo-effect, incoherent scattering, and pair and triplet production are those compiled or generated by the National Institute of Standards and Technology (NIST). Corrections are included for inflight positron annihilation, previously not applied in NIST calculations for energies above 10 MeV. Author

N92-21584# Argonne National Lab., IL.
INTENSE PULSED NEUTRON SOURCE Progress Report, 1991
1991 168 p
(Contract W-31-109-eng-38)
(DE92-006579; ANL/RP-74884) Avail: NTIS HC/MF A08

The IPNS Progress Report 10th Anniversary Edition is being published in recognition of the first ten years of successful IPNS operation. To emphasize the significance of this milestone, we wanted this report to stand apart from the previous IPNS Progress Reports, and the best way to do this, we thought, was to make the design and organization of the report significantly different. In their articles, authors were asked to emphasize not only advances made since IPNS began operating but also the groundwork that was laid at its predecessor facilities - Argonne's ZING-P and ZING-P' prototype pulsed neutron sources and CP-5 reactor. Each article stands as a separate chapter in the report, since each represents a particular instrument or class of instruments, system, technique, or area of research. In some cases, contributions were similar to review articles in scientific journals, complete with extensive lists of references. Ten-year cumulative lists of members of IPNS committees and of scientists who have visited or done experiments at IPNS were assembled. A list of published and 'in press' articles in journals, books, and conference proceedings, resulting from work done at IPNS during the past ten years, was compiled. And archival photographs of people and activities during the ten-year history of IPNS were located and were used liberally throughout the report. The titles of the chapters in this report are: accelerator; computer; radiation effects; powder; stress; single crystal; superconductivity; amorphous; small angle; reflection; quasielastic; inelastic; inelastic magnetic; deep inelastic; user program; the future; and publications. DOE

N92-21707# Oak Ridge National Lab., TN.
FRACTAL NATURE OF HUMIC MATERIALS
J. A. Rice (South Dakota State Univ., Brookings.) and J. S. Lin 1992 4 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC05-84OR-21400)
(DE92-007829; CONF-920444-12) Avail: NTIS HC/MF A01

Fractals are geometric representatives of strongly disordered systems whose structure is described by nonintegral dimensions. A fundamental tenet of fractal geometry is that disorder persists at any characterization scale-length used to describe the system. The nonintegral nature of these fractal dimensions is the result of the realization that a disordered system must possess more structural detail than an ordered system with classical dimensions of 1, 2, or 3 in order to accommodate this 'disorder within disorder.' Thus from a fractal perspective, disorder is seen as an inherent characteristic of the system rather than as a perturbative phenomena forced upon it. Humic materials are organic substances that are formed by the profound alteration of organic matter in a natural environment. They can be operationally divided into 3 fractions; humic acid (soluble in base), fulvic acid (soluble in acid or base), and humin (insoluble in acid or base). Each of these fractions has been shown to be an extremely heterogeneous mixture. These mixtures have proven so intractable that they may represent the ultimate in molecular disorder. In fact, based on the characteristics that humic materials must possess in order to perform their functions in natural systems, it has been proposed that the fundamental chemical characteristic of a humic material is not a discrete chemical structure but a pronounced lack of order on a molecular level. If the fundamental chemical characteristic of a humic material is a strongly disordered nature, as has been proposed, then humic materials should be amenable to characterization by fractal geometry. The purpose of this paper is to test this hypothesis. DOE

N92-21758# Florida Univ., Gainesville.
ELEMENTARY PARTICLE PHYSICS AT THE UNIVERSITY OF FLORIDA
1 Dec. 1991 164 p
(Contract DE-FG05-86ER-40272)
(DE92-007994; DOE/ER-40272/150; UFIFT-HEP-92-3) Avail: NTIS HC/MF A08

This report discusses research in the following areas: theoretical elementary particle physics; experimental elementary particle physics; axion project; SSC detector development; and computer acquisition. DOE

N92-21766# Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.
INVESTIGATIONS OF NUCLEAR MAGNETISM IN SILVER DOWN TO PICOKELVIN TEMPERATURES 1
A. S. Oja, A. J. Annila, and Y. Takano May 1991 33 p
(PB92-134154; TKK-F-A686; ISBN-951-22-0626-9) Avail: NTIS HC/MF A03 CSCL 20H

Nuclear magnetic ordering in silver was investigated by the low-field nuclear magnetic resonance (NMR) technique, using a radio frequency SQUID. Spin entropies down to 0.50 RIn2, corresponding to polarizations up to 78 percent, were obtained. An indication of antiferromagnetic ordering was observed in the static magnetic susceptibility, which showed clear saturation at the beginning of warmup after cooling to T less than 1 nK by adiabatic demagnetization to B = 10 + or - 5(mu)T; the critical entropy of the transition was found to be S(c) = (0.60 + or - 0.04) RIn2. The NMR absorption increased in the ordered state at frequencies around 75 Hz. Remnants of the increase were observed in the paramagnetic phase as well. The feasibility of experiments at negative spin temperatures was demonstrated by a quick reversal of the external magnetic field. GRA

N92-21788# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
EXISTENCE OF NON-TOPOLOGICAL SOLITONS IN THE SELF-DUAL CHERN-SIMONS THEORY
J. Spruck and Y. Yang Nov. 1991 24 p Prepared in cooperation with Massachusetts Univ.,Amherst, and New Mexico Univ., Albuquerque
(Contract DE-FG02-86ER-250125; NSF DMS-88-02858)
(PB92-134402; IHES/M/91/81) Avail: NTIS HC/MF A03 CSCL 20H

In the recently discovered (2+1) dimensional relativistic Chern-Simons model, self duality can be achieved when the Higgs potential density assumes a special form for which both the asymmetric and symmetric vacua are ground state solutions. This important feature may imply the coexistence of static topological and nontopological vortex-like solutions in R(sup 2) but the latter have been rather elusive to a rigorous construction. An attempt was made to prove the existence of nontopological radially symmetric N-vortex solutions in the self-dual Chern-Simons model. By a shooting method, one obtains a continuous family of gauge distinct N-vortex solutions. Moreover, one is also able to classify all possible bare (or 0-vortex) solutions. Author

N92-21988# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
GEOMETRICAL AND ELECTRONICAL STRUCTURE OF MOLECULES AND MOLECULAR FRAGMENTS ON MONOCRYSTAL SURFACES Ph.D. Thesis [GEOMETRISCHE UND ELEKTRONISCHE STRUKTUR VON MOLEKUELEN UND MOLEKUELFRAGMENTEN AUF EINKRISTALLOBERFLAECHEN]
Egbert Ricken 1991 132 p In GERMAN
(ETN-92-91156) Avail: NTIS HC/MF A07

A detailed examination of adsorption geometry is obtained by energy dependent photoelectron diffraction measurements which can only be carried out by synchrotron radiation. By the comparison of experimental data and simulation calculations, the exact adsorption place and the bonding length between adsorbate and substrate atoms can be determined. Measurements for different photon energies show a distinct resonance effect, which is to be attributed to the interaction of a filled molecular orbit with empty states. ESA

N92-21992# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
ANGULAR RESOLVED ELECTRON SPECTROMETRY OF MANY ELECTRON PROCESS BY PHOTOIONIZATION Ph.D. Thesis [WINKELAUFGELOESTE ELEKTRONENSPEKTROMETRIE VON MEHRELEKTRONENPROZESSEN BEI DER PHOTOIONISATION]
Ralf Wehlitz 1991 134 p In GERMAN
(ETN-92-91160) Avail: NTIS HC/MF A07

The double ionization was examined for helium, neon, argon, and for CO and N2. The measurement of helium three body system was of particular importance. The experiments were carried out, using monochromatized synchrotron radiation, of the storage rings DORIS2 and BESSY. The distribution of kinetic energy and excitation energy dependency of photoelectrons resulting form the simultaneous double ionization, were examined. From the measurement carried out for helium, a simple model could be developed for the angular distribution of the shakeoff electrons of other inert gases. Auger dissociations of double punch vacancies were produced by photoionization with simultaneous excitation. ESA

N92-22067*# Sogang Univ., Seoul (Republic of Korea). Dept. of Physics.
RADIATION FORCE ON A SINGLE ATOM IN A CAVITY
M. S. Kim *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 217-224 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20H

N92-22071*# Australian National Univ., Canberra. Dept. of Physics and Theoretical Physics.
SHORT-CAVITY SQUEEZING IN BARIUM
D. M. Hope, H-A. Bachor, P. J. Manson, and D. E. McClelland *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 237-239 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N92-21103# Maryland Univ., College Park.
BEAM LOADING IN A HIGH CURRENT ACCELERATING GAP
M. J. Rhee and B. N. Ding 1991 3 p Presented at the 1991 Institute of Electrical and Electronics Engineers (IEEE) Particle Accelerator Conference (PAC), San Francisco, CA, 6-11 May 1991
(Contract DE-FG05-91ER-40642)
(DE92-003230; CONF-910505-440) Avail: NTIS HC/MF A01

Energy exchange between a high-current beam and a source at an accelerating gap is treated with a simple transmission line theory. There exists a matching condition for which the beam energy gain is equal to the source voltage. The total energy gain in a multigap system is expressed in terms of individual source voltages and the beam current. DOE

N92-21131# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THEORETICAL AND EXPERIMENTAL HIGH ENERGY PHYSICS
T. Walsh and K. Ruddick 1990 83 p
(Contract DE-AC02-83ER-40105)
(DE92-006707; DOE/ER-40105/800) Avail: NTIS HC/MF A05

This report discusses the following topics: The Soudan enterprise; study of strange quarks at Fermilab; direct photons at Fermilab; the Brookhaven programs; AMY and CLEO: studies of e(+)e(-) annihilations; cosmic ray studies with the DO muon chamber; progress report on HEP computer upgrade; muon triggering and reconstruction at SSC; and, theoretical high energy physics. DOE

N92-21132# Colorado Univ., Boulder. Dept. of Physics.
UNIVERSITY OF COLORADO HIGH ENERGY PHYSICS Progress Report, 1990 - 1991
G. Baranko, J. Cumalat, S. P. deAlwis, T. DeGrand, W. T. Ford, K. T. Mahanthappa, U. Nauenberg, P. Rankin, and J. G. Smith Jun. 1991 96 p
(Contract DE-AC02-86ER-40253)
(DE92-006717; DOE/ER-40253/1; COLO-HEP-255) Avail: NTIS HC/MF A05

This report discusses: High energy photoproduction of states containing heavy quarks; electron-positron physics with the Mark II detector at SLC; the study of the properties of the Z(sup 0) with the SLD detector; electron-positron physics with the CLEO II detector at CESR; central tracking for the SDC detector; the R&D program of the muon group in the SDC detector; mostly lattice QCD; spin models and dynamically triangulated random surfaces; string theory and quantum gravity; and reanalysis of a measurement of fifth force. DOE

N92-21182# Argonne National Lab., IL.
RECENT DEVELOPMENTS IN RF SUPERCONDUCTIVITY FOR HIGH-BRIGHTNESS AND HIGH-GRADIENT ION BEAM ACCELERATORS
J. R. Delayen, C. L. Bohn, W. L. Kennedy, G. L. Nichols, C. T. Roche, and L. Sagalovsky 1992 7 p Presented at the Society of Photo-Optical Instrumentation Engineers' International Symposium on Laser Spectroscopy as part of SPIE's Symposium on Optics, Electro-Optics and Laser Applications in Science and Engineering, Los Angeles, CA
(Contract W-31-109-eng-38)
(DE92-007370; ANL/CP-75244; CONF-920124-7) Avail: NTIS HC/MF A02

Recent progress in an ongoing development program leading to the design of superconducting continuous-wave (cw) linear accelerators for high-brightness ion beams is reviewed. A new spoke-resonator geometry incorporating a half-wavelength resonant line was fabricated and tested. This geometry serves as the basis for the constituent cavities of a superconducting section being designed for high-current testing with a deuterium beam. Considerable progress has been made in the design of this section. A multi-phased program leading to the development of a superconducting radio-frequency quadrupole (SCRFQ) has been initiated. Design considerations and test results from the various activities are presented. DOE

N92-21194# Stanford Linear Accelerator Center, CA.
THE GENERATION AND ACCELERATION OF LOW EMITTANCE FLAT BEAMS FOR FUTURE LINEAR COLLIDERS Ph.D. Thesis

T. O. Raubenheimer Nov. 1991 251 p
(Contract DE-AC03-76SF-00515)
(DE92-007395; SU-SLAC-387) Avail: NTIS HC/MF A12

Many future linear collider designs call for electron and positron beams with normalized rms horizontal and vertical emittances of gamma epsilon(sub x) = 3 x 10(exp -6) m-rad and gamma epsilon (sub y) = 3 x 10(exp -8) m-rad; these are a factor of 10 to 100 below those observed in the Stanford Linear Collider. In this dissertation, we examine the feasibility of achieving beams with these very small vertical emittances. We examine the limitations encountered during both the generation and the subsequent acceleration of such low emittance beams. We consider collective limitations, such as wakefields, space charge effects, scattering processes, and ion trapping; and also how intensity limitations, such as anomalous dispersion, betatron coupling, and pulse-to-pulse beam jitter. In general, the minimum emittance in both the generation and the acceleration stages is limited by the transverse misalignments of the accelerator components. We describe a few techniques of correcting the effect of these errors, thereby easing the alignment tolerances by over an order of magnitude. Finally, we also calculate 'fundamental' limitations on the minimum vertical emittance; these do not constrain the current designs but may prove important in the future. DOE

N92-21217# Pacific Northwest Lab., Richland, WA.
MARS MISSION PERFORMANCE ENHANCEMENT WITH HYBRID NUCLEAR PROPULSION
J. E. Dagle, K. E. Noffsinger, and D. R. Segna (Richland Operations Office, AEC, WA) Jan. 1992 7 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contract DE-AC06-76RL-01830)
(DE92-006729; PNL-SA-20132; CONF-920104-29) Avail: NTIS HC/MF A02

Nuclear electric propulsion (NEP), compared with chemical and nuclear thermal propulsion (NTP), can effectively deliver the same mass to Mars using much less propellant, consequently requiring less mass delivered to Earth orbit. The lower thrust of NEP requires a spiral trajectory near planetary bodies, which significantly increases the travel time. Although the total travel time is long, the portion of the flight time spent during interplanetary transfer is shorter, because the vehicle is thrusting for much longer periods of time. This has led to the supposition that NEP, although very attractive for cargo missions, is not suitable for piloted missions to Mars. However, with the application of a hybrid application of a hybrid approach to propulsion, the benefits of NEP can be utilized while drastically reducing the overall travel time required. Development of a dual-mode system, which utilizes high-thrust NTP to propel the spacecraft from the planetary gravitational influence and low-thrust NEP to accelerate in interplanetary space, eliminates the spiral trajectory and results in a much faster transit time than could be obtained by either NEP or NTP alone. This results in a mission profile with a lower initial mass in low Earth orbit. In addition, the propulsion system would have the capability to provide electrical power for mission applications. DOE

N92-21986# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Engineering Energie- und Anlagentechnik.
SUMMARY OF THE CONTRIBUTIONS TO REACTOR SAFETY RESEARCH COMMISSIONED BY THE REPUBLIC OF AUSTRIA AND DONE BY THE SEIBERSDORF RESEARCH CENTER FROM 1987 TO 1990
Gerald Sonneck and Gert Sdouz Sep. 1991 50 p In GERMAN; ENGLISH summary
(OEFZS-4594; ETN-92-91106) Copyright Avail: NTIS HC/MF A03

Work done on the LOFT OECD (Loss of Fluid Tests) Program and the International Coordinated Assessment and Application Program (ICAAP) is addressed. The work done from 1987 to 1990 in the field of thermal hydraulics and fuel rod behavior is summarized. Analysis of experiments done in loops in boiling water reactors (BWR) and pressurized water reactors (PWR) of western design are described. Most of the work however concentrated on WWER type reactors. ESA

N92-21990# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
THE BESSY ELECTRON STORAGE RING AS RADIATION STANDARD IN X RAY FIELD, AND THE DETERMINATION OF RADIONUCLIDE PHOTON EMISSION PROBABILITIES Ph.D. Thesis [DER ELEKTRONENSPEICHERRING BESSY ALS STRAHLUNGSNORMAL IM ROENTGENBEREICH UND DIE BESTIMMUNG DER PHOTONENEMISSIONSWAHRSCHEINLICHKEITEN VON RADIONUKLIDEN]
Dirk Arnold 1991 130 p In GERMAN
(ETN-92-91158) Avail: NTIS HC/MF A07

The suitability of the BESSY electron storage ring as a primary radiation standard was verified in a photon energy field. The extension of the usable spectral field to greater photon energies was obtained by an increase of electron energy from 750 to 850 MeV. The measurement processes for the determination of storage ring and geometry parameters were improved. A filter detector system and a gamma line of a radioactive standard were calibrated in order to examine possible deviations in the realized units at transfer from the radioactive standard to the storage ring standard. The quality of the radioactive standards considered was improved. ESA

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N92-21120# Lawrence Livermore National Lab., CA.
A VIDEO HARTMANN WAVEFRONT DIAGNOSTIC THAT INCORPORATES A MONOLITHIC MICROLENS ARRAY
J. S. Toeppen, E. S. Bliss, T. W. Long, and J. T. Salmon Jul. 1991 10 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-006892; UCRL-JC-105996; CONF-9107115-63) Avail: NTIS HC/MF A02

We have developed a video Hartmann wavefront sensor that incorporates a monolithic array of microlenses as the focusing elements. The sensor uses a monolithic array of photofabricated lenslets. Combined with a video processor, this system reveals local gradients of the wavefront at a video frame rate of 30 Hz. Higher bandwidth is easily attainable with a camera and video processor that have faster frame rates. When used with a temporal filter, the reconstructed wavefront error is less than 1/10th wave. DOE

N92-21144# Lawrence Livermore National Lab., CA.
REAL-TIME WAVEFRONT CORRECTION SYSTEM USING A ZONAL DEFORMABLE MIRROR AND A HARTMANN SENSOR
J. T. Salmon, E. S. Bliss, T. W. Long, E. L. Orham, R. W. Presta, C. D. Swift, and R. S. Ward Jul. 1991 11 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-006891; UCRL-JC-105847; CONF-9107115-64) Avail: NTIS HC/MF A03

We have developed an adaptive optics system that corrects up to five waves of 2nd-order and 3rd-order aberrations in a high-power laser beam to less than 1/10th wave RMS. The wavefront sensor is a Hartmann sensor with discrete lenses and position-sensitive photodiodes; the deformable mirror uses piezoelectric actuators with feedback from strain gauges bonded to the stacks. The controller hardware uses a VME bus. The system removes thermally induced aberrations generated in the master-oscillator-power-amplifier chains of a dye laser, as well as aberrations generated in beam combiners and vacuum isolation

windows for average output powers exceeding 1 kW. The system bandwidth is 1 Hz, but higher bandwidths are easily attainable. DOE

N92-21295# Wright State Univ., Dayton, OH. Dept. of Computer Science.
INVESTIGATING DIGITAL OPTICAL COMPUTING WITH SPATIAL LIGHT REBROADCASTERS Final Report, 1 Sep. 1989 - 30 Sep. 1991
Alastair D. McAulay, Junqing Wang, and Xin Xu 31 Oct. 1991 57 p
(Grant AF-AFOSR-0525-89)
(AD-A244466; WSU-CS-91-11; AFOSR-91-1026TR) Avail: NTIS HC/MF A04 CSCL 20/6

Spatial light rebroadcasters (SLR's) consisting of thin films of luminescing electron trapping materials, are explored for digital optical computing. The status of optical computing is reviewed briefly. SLR's are characterized in detail; fabrication, sensitivity, linearity, speed, resolution, and modulation. A number of optical experiments are described that were conducted to determine the device effectiveness, applications for which the devices are best suited, and the direction for research to develop more useful devices. Optical experiments with basic SLR modules include a cascadable module, binary matrix-vector multiplier, and correlator. The basic modules were then used in memory, adder, interconnection, and learning experiments. These experiments show that the SLR has potential for digital optical computing, particularly where high density long term storage is required. However, the lack of gain, incoherent output, and lot output signal means that other collaborative devices are needed which limit the performance. Future directions are discussed. GRA

N92-21550# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.
MEMBRANE DISH ANALYSIS: A SUMMARY OF STRUCTURAL AND OPTICAL ANALYSIS CAPABILITIES
C. R. Steele, C. D. Balch, G. J. Jorgensen, T. Wendelin, and A. Lewandowski Nov. 1991 196 p
(Contract DE-AC02-83CH-10093)
(DE91-002162; NREL/TP-253-3432) Avail: NTIS HC/MF A09

Research at SERI within the Department of Energy's Solar Thermal Technology Program has focused on the development of membrane dish concentrators for space and terrestrial power applications. As potentially lightweight, inexpensive, high performance structures, they are excellent candidates for space-deployable energy sources as well as cost effective terrestrial energy concepts. A thorough engineering research treatment of these types of structures consists primarily of two parts: (1) structural mechanics of the membrane and ring support, and (2) analysis and characterization of the concentrator optical performance. It is important to understand the effects of the membrane's structure and support system on the optical performance of the concentrator. This requires an interface between appropriate structural and optical models. Until recently, such models and the required interface have not existed. This report documents research that has been conducted at SERI in this area. It is a compilation of several papers describing structural models of membrane dish structures and optical models used to predict dish concentrator optical and thermal performance. The structural models were developed under SERI subcontract by Dr. Steele and Dr. Balch of Stanford University. The optical model was developed in-house by SERI staff. In addition, the interface between the models is described. It allows easy and thorough characterization of membrane dish systems from the mechanics to the resulting optical performance. The models described herein have been and continue to be extremely useful to SERI, industry, and universities involved with the modeling and analysis of lightweight membrane concentrators for solar thermal applications. DOE

N92-21575# Sandia National Labs., Albuquerque, NM.
X RAY AND VISIBLE LIGHT TRANSMISSION AS TWO-DIMENSIONAL, FULL-FIELD MOISTURE-SENSING TECHNIQUES: A PRELIMINARY COMPARISON
V. C. Tidwell and R. J. Glass 21 Jan. 1992 12 p Presented at the International High Level Radioactive Waste Management Conference: Las Vegas, NV, 12-16 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006836; SAND-91-1983C; CONF-920430-43) Avail: NTIS HC/MF A03

Two independent high resolution moisture sensing techniques, x ray absorption and light transmission, have been developed for use in two dimensional, thin slab experimental systems. The techniques yield full field measurement capabilities with exceptional resolution of moisture content in time and space. These techniques represent powerful tools for the experimentalist to investigate processes governing unsaturated flow and transport through fractured and nonfractured porous media. Evaluation of these techniques has been accomplished by direct comparison of data obtained by means of the x ray and light techniques as well as comparison with data collected by gravimetric and gamma ray densitometry techniques. Results show excellent agreement between data collected by the four moisture content measurement techniques. This program was established to support the Yucca Mountain Site Characterization Project. DOE

N92-21739# Rolls-Royce Ltd., Derby (England). Advanced Research Lab.
USE OF RETROREFLECTIVE MATERIAL FOR PSEUDO SINGLE-ENDED CARS
John D. Black and Richard J. Parker 1 Aug. 1990 10 p Presented at the Opt. Commun., 21 Jun. 1990
(PNR-90767; ETN-92-90759) Copyright Avail: NTIS HC/MF A02

Use of the retroreflective materials composed of miniature corner cube reflectors in CARS (Coherent AntiStokes Raman Spectroscpy) was demonstrated, with a view to their application where no line of sight access is available. Spectra were obtained in air and laboratory flames using commercial 'load sign' material to retroreflect CARS signal beams. ESA

N92-21798# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
INVARIANTS IN VISUAL MOTION
D. Raviv Nov. 1991 24 p Prepared in cooperation with Florida Atlantic Univ., Boca Raton
(PB92-133016; NISTIR-4722) Avail: NTIS HC/MF A03 CSCL 20F

New and simple representations of 3-D points in a moving-observer coordinate system are addressed. Assuming rectilinear motion with no rotation of an observer where the optical axis coincides with the direction of motion, and a stationary scene, points in 3-D space that lie on a particular 3-D surface produce constant value of some nonlinear function of the measurable image optical flow. Five sets of different surfaces are introduced, and there is one optical-flow based constant value for each surface. These values are called 'invariants'. It is shown how to extract these invariants and how to use them for representing 3-D space. GRA

N92-21801# Helsinki Univ. of Technology, Espoo (Finland). Communications Lab.
CALCULATION OF LOCAL AND GLOBAL POLARIZATION IN AN OPTICAL MULTIMODE FIBER
P. M. Rodhe 5 Sep. 1991 25 p
(PB92-133529; T-30) Avail: NTIS HC/MF A03 CSCL 20F

Local and global polarization states in the near field of a multimode fiber were studied, and new formulas for the global Stokes parameters were developed. By considering separate frequency components of the guided modes, one can show depolarization due to dispersion effects. Calculations for an isotropic circular step index fiber expose large variations in

polarization both across the fiber core and as a function of fiber length. The results are indicative of new signal processing applications. Author

N92-21819# Michigan Univ., Ann Arbor. Transportation Research Inst.
JOINT EFFECTS OF WAVELENGTH AND AMBIENT LUMINANCE ON DISCOMFORT GLARE FROM MONOCHROMATIC AND BICHROMATIC SOURCES
M. J. Flannagan, M. Sivak, and A. W. Gellatly Nov. 1991 42 p (PB92-131903; UMTRI-91-42) Avail: NTIS HC/MF A03 CSCL 20F

Recent developments in headlighting and rearview mirror technology have increased the need to understand possible effects of the color of a glare source on discomfort glare. That need is addressed by partially replicating and extending a previous study in which subjects rated the discomfort glare experienced from monochromatic stimuli. Herein, five subjects rated the discomfort glare experienced from monochromatic stimuli of 480 nm and 577 nm, as well as from a bichromatic mixture of those wavelengths that was balanced to appear white. Two levels of background luminance were used. Results are summarized in terms of discomfort glare efficiency functions, analogous to the photopic and scotopic luminous efficiency functions. At the dimmer background luminance level glare efficiency follows scotopic luminous efficiency. At the brighter background level glare efficiency shifts partially toward photopic luminous efficiency. Discomfort glare ratings for the bichromatic mixture agree well with predictions based on an additive combination of responses to the monochromatic stimuli, although the precision of the data is such that the possibility cannot be ruled out of a departure from additivity. These results suggest that the glare properties of colored sources can be predicted by using an efficiency function similar to the scotopic luminous efficiency function. Author

N92-21982# National Academy of Sciences - National Research Council, Washington, DC. Board on Mathematical Sciences.
MATHEMATICAL OPPORTUNITIES IN NONLINEAR OPTICS
1992 59 p Sponsored by NSF; AFOSR; DOE; IBM; National Security Agency; and ONR Prepared in cooperation with National Academy of Engineering, Washington, DC
Avail: NTIS HC/MF A04

Optics is described in this survey as being so scientifically fertile and technologically promising that it is destined to be one of the most important areas of science for the next quarter century. The study of nonlinear optics is fascinating both because of the enormous technological dividends that are likely and because of the intrinsic scientific interest. This survey notes that on the technological side nonlinear optics is likely to revolutionize future telecommunications and computer technologies, while on the mathematical side it is an ideal subject for the applied mathematician, who is particularly well positioned to make major contributions. Also, optics displays the full spectrum of behavior associated with nonlinear equations. There are several new concepts of nonlinear science, including the soliton and the strange attractor, which are very important in nonlinear optics and which require some depth of mathematical knowledge to understand. Author

N92-21987# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
NONLINEAR OPTICAL PROPERTIES OF HIGH DOPED CdS:In CRYSTALS Ph.D. Thesis [NICHTLINEARE OPTISCHE EIGENSCHAFTEN HICHDOTIERTER CDS:IN-KRISTALLE]
Ulrich Neukirch 1991 171 p In GERMAN
(ETN-92-91154) Avail: NTIS HC/MF A08

It is shown that high doped concentrations considerably change the electronic structure and the optical properties of semiconductors. The optical properties of various high doped CdS:In crystals are examined. Measurements of the optical intensification show the bands as a succession of stimulations of radiating band recombinations. In low excited high doped crystals, as in high excited non doped crystals, the two body complex exciton is not stable with regard to the screening of the Coulomb interactions. The excitation of the charge carrier leads to a plasma. ESA

N92-22034* National Aeronautics and Space Administration. Pasadena Office, CA.
EQUAL PATH, PHASE SHIFTING, SAMPLE POINT INTERFEROMETER FOR MONITORING THE CONFIGURATION OF SURFACES Patent
Paul K. Manhart, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 14 Jan. 1992 9 p Filed 23 May 1990 Supersedes N90-27488 (28 - 21, p 3076)
(NASA-Case-NPO-17913-1-CU; US-Patent-5,080,490; US-Patent-Appl-SN-527509; US-Patent-Class-356-351; US-Patent-Class-356-360; US-Patent-Class-356-363; Int-Patent-Class-G01B-9/02) Avail: US Patent and Trademark Office CSCL 20F

A system for monitoring the configuration of a surface (e.g., a segmented parabolic surface) using orthogonally placed retroreflectors at sets of points 1, 2, and 3 dispersed throughout the surface with a stationary halfwave plate (HWP) in the front of the one retroreflector at a corner point 3 and a rotating halfwave plate (RHWP) over a source of linearly polarized coherent light, thereby causing the direction of linear polarization to continuously rotate through 360 deg and causing light returned by the retroreflector at point 3 to be continuously phase shifted through 360 deg relative to light returned by retroreflectors at points 1 and 2. The returned light from each set of points 1, 2, and 3 is focused onto a bed-of-nails (BON) phase grating diagonally oriented with respect to the orthogonal orientation of the incident beams from retroreflectors 1, 2, and 3, thereby causing overlap in the light from points 1 and 3 to produce interferometric signals 1,3 and 2,3. Any change in phase of the interferometric signals 1,3 and 2,3 indicates both the magnitude and direction of any change in the position of the retroreflector at point 3 relative to retroreflectors at points 1 and 2.
Official Gazette of the U.S. Patent and Trademark Office

N92-22045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
WORKSHOP ON SQUEEZED STATES AND UNCERTAINTY RELATIONS
Daesoo Han, ed., Y. S. Kim, ed., and W. W. Zachary, ed. (Howard Univ., Washington, DC.) Washington Feb. 1992 385 p Workshop held in College Park, MD, 28-30 Mar. 1991
(NASA-CP-3135; Rept-92B00024; NAS 1.15:3135) Avail: NTIS HC/MF A17 CSCL 20F

The proceedings from the workshop are presented, and the focus was on the application of squeezed states. There are many who say that the potential for industrial applications is enormous, as the history of the conventional laser suggests. All those who worked so hard to produce squeezed states of light are continuing their efforts to construct more efficient squeezed-state lasers. Quite naturally, they are looking for new experiments using these lasers. The physical basis of squeezed states is the uncertainty relation in Fock space, which is also the basis for the creation and annihilation of particles in quantum field theory. Indeed, squeezed states provide a unique opportunity for field theoreticians to develop a measurement theory for quantum field theory. For individual titles, see N92-22046 through N92-22088.

N92-22046*# Rochester Univ., NY. Dept. of Physics and Astronomy.
NONCLASSICAL AND NONLOCAL EFFECTS IN THE INTERFERENCE OF LIGHT
L. Mandel *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 5-12 Sponsored in part by NSF and Navy (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Although we tend to think of optical interference as a classical wave phenomenon, recent experiments have revealed a number of effects that are not describable in classical terms. This is

particularly true of interference effects involving the detection of a photon pair. We shall refer to them as fourth order interference, on the grounds that the joint probability density for the detection of one photon at r sub 1 at time t and another r sub 2 at time t is proportional to the fourth order correlation function of the field. This probability is readily measured when two photodetectors are positioned at r sub 1 and r sub 2 and the signals from the two detectors are fed to a coincidence counter that registers 'simultaneous' detections by the two detectors in coincidence. The topics covered include: fourth order interference measurements; the Franson experiment; and experimental test of the de Broglie guided wave theory. Author

N92-22047*# Northwestern Univ., Evanston, IL. Dept. of Electrical Engineering and Computer Science.
THE ULTIMATE QUANTUM LIMITS ON THE ACCURACY OF MEASUREMENTS
Horace P. Yuen *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 13-21 Sponsored in part by Navy (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

A quantum generalization of rate-distortion theory from standard communication and information theory is developed for application to determining the ultimate performance limit of measurement systems in physics. For the estimation of a real or a phase parameter, it is shown that the root-mean-square error obtained in a measurement with a single-mode photon level N cannot do better than approximately N exp -1, while approximately exp(-N) may be obtained for multi-mode fields with the same photon level N. Possible ways to achieve the remarkable exponential performance are indicated. Author

N92-22048*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
VIOLATIONS OF A NEW INEQUALITY FOR CLASSICAL FIELDS
J. D. Franson *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 23-32 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Two entangled photons incident upon two distant interferometers can give a coincidence counting rate that depends nonlocally on the sum of the phases of the two interferometers. It has recently been shown that experiments of this kind may violate a simple inequality that must be satisfied by any classical or semi-classical field theory. The inequality provides a graphic illustration of the lack of objective realism of the electric field. The results of a recent experiment which violates this inequality and in which the optical path length between the two interferometers was greater than 100 m are briefly described. Author

N92-22049*# Stonehill Coll., North Easton, MA.
USE OF ENTANGLEMENT IN QUANTUM OPTICS
Michael A. Horne, Herbert J. Bernstein, Daniel M. Greenberger, and Anton Zeilinger (Atominstitut der Oesterreichischen Hochschulen, Vienna.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 33-46 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Several recent demonstrations of two-particle interferometry are reviewed and shown to be examples of either color entanglement or beam entanglement. A device, called a number filter, is described and shown to be of value in preparing beam entanglements. Finally, we note that all three concepts (color and beam entaglement, and number filtering) may be extended to three or more particles. Author

N92-22050*# Maryland Univ. Baltimore County, Catonsville. Dept. of Physics.
EPR EXPERIMENT AND 2-PHOTON INTERFEROMETRY: REPORT OF A 2-PHOTON INTERFERENCE EXPERIMENT
Y. H. Shih, M. H. Rubin, and A. V. Sergienko *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 47-59 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

After a very brief review of the historical Einstein, Podolsky, and Rosen (EPR) experiments, a new two-photon interference type EPR experiment is reported. A two-photon state was generated by optical parametric down conversion. Pairs of light quanta with degenerate frequency but divergent directions of propagation were sent to two independent Michelson interferometers. First and second order interference effectors were studied. Different than other reports, we observed that the second order interference visibility vanished when the optical path difference of the interferometers were much less than the coherence length of the pumping laser beam. However, we also observed that the second order interference behaved differently depending on whether the interferometers were set at equal or different optical path differences. Author

N92-22051*# California Univ., Berkeley. Dept. of Physics.
THE ENERGY-TIME UNCERTAINTY PRINCIPLE AND THE EPR PARADOX: EXPERIMENTS INVOLVING CORRELATED TWO-PHOTON EMISSION IN PARAMETRIC DOWN-CONVERSION
Raymond Y. Chiao, Paul G. Kwiat, and Aephraim M. Steinberg *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 61-71 (For primary document see N92-22045 12-74)
(Contract N00014-90-J-1259)
Avail: NTIS HC/MF A17 CSCL 20F

The energy-time uncertainty principle is on a different footing than the momentum position uncertainty principle: in contrast to position, time is a c-number parameter, and not an operator. As Aharonov and Bohm have pointed out, this leads to different interpretations of the two uncertainty principles. In particular, one must distinguish between an inner and an outer time in the definition of the spread in time, delta t. It is the inner time which enters the energy-time uncertainty principle. We have checked this by means of a correlated two-photon light source in which the individual energies of the two photons are broad in spectra, but in which their sum is sharp. In other words, the pair of photons is in an entangled state of energy. By passing one member of the photon pair through a filter with width delta E, it is observed that the other member's wave packet collapses upon coincidence detection to a duration delta t, such that delta E(delta t) is approximately equal to planks constant/2 pi, where this duration delta t is an inner time, in the sense of Aharonov and Bohm. We have measured delta t by means of a Michelson interferometer by monitoring the visibility of the fringes seen in coincidence detection. This is a nonlocal effect, in the sense that the two photons are far away from each other when the collapse occurs. We have excluded classical-wave explanations of this effect by means of triple coincidence measurements in conjunction with a beam splitter which follows the Michelson interferometer. Since Bell's inequalities are known to be violated, we believe that it is also incorrect to interpret this experimental outcome as if energy were a local hidden variable, i.e., as if each photon, viewed as a particle, possessed some definite but unknown energy before its detection. Author

N92-22052*# Innsbruck Univ. (Austria). Inst. fuer Experimentalphysik.
HIGHER-ORDER QUANTUM ENTANGLEMENT
Anton Zeilinger, Michael A. Horne, and Daniel M. Greenberger (City Coll. of the City Univ. of New York, NY.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 73-81 (For primary document see N92-22045 12-74)
(Grants NSF DMR-87-13559; NSF INT-87-13341; AFFF Proj. S42-01; AFFF Proj. P-6635)
Avail: NTIS HC/MF A17 CSCL 20F

In quantum mechanics, the general state describing two or more particles is a linear superposition of product states. Such a

superposition is called entangled if it cannot be factored into just one product. When only two particles are entangled, the stage is set for Einstein-Podolsky-Rosen (EPR) discussions and Bell's proof that the EPR viewpoint contradicts quantum mechanics. If more than two particles are involved, new possibilities and phenomena arise. For example, the Greenberger, Horne, and Zeilinger (GHZ) disproof of EPR applies. Furthermore, as we point out, with three or more particles even entanglement itself can be an entangled property. Author

N92-22053*# North Carolina Univ., Chapel Hill. Dept. of Physics and Astronomy.
ALGORITHMIC INFORMATION THEORY AND THE HIDDEN VARIABLE QUESTION
Christopher Fuchs *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 83-85 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

The admissibility of certain nonlocal hidden-variable theories are explained via information theory. Consider a pair of Stern-Gerlach devices with fixed nonparallel orientations that periodically perform spin measurements on identically prepared pairs of electrons in the singlet spin state. Suppose the outcomes are recorded as binary strings l and r (with l sub n and r sub n denoting their n-length prefixes). The hidden-variable theories considered here require that there exists a recursive function which may be used to transform l sub n into r sub n for any n. This note demonstrates that such a theory cannot reproduce all the statistical predictions of quantum mechanics. Specifically, consider an ensemble of outcome pairs (l,r). From the associated probability measure, the Shannon entropies H sub n and H bar sub n for strings l sub n and pairs (l sub n, r sub n) may be formed. It is shown that such a theory requires that the absolute value of H bar sub n - H sub n be bounded - contrasting the quantum mechanical prediction that it grow with n. Author

N92-22054*# Maryland Univ., College Park. Dept. of Physics.
PHOTON POLARIZATION VERSION OF THE GHz-MERMIN GEDANKEN
Thomas E. Kiess *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 87-89 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

We have defined a photon polarization analog of the Greenberger, Horne, and Zeilinger (GHZ) experiment that was initially proposed for spin-1/2 quanta. Analogs of the ket states and Pauli spin matrix operators are presented. Author

N92-22055*# Oregon Univ., Eugene. Dept. of Physics.
PROPOSAL FOR A QND WHICH-PATH MEASUREMENT USING PHOTONS
M. G. Raymer and S. Yang *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 91-93 Sponsored in part by NSF (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

A scheme is proposed for experimentally realizing the famous two-slit gedaenken experiment using photons. As elegantly discussed for electrons by Feynman, a particle's quantum pathways interfere to produce fringes in the probability density for the particle to be found at a particle location. If the path taken by the particle is experimentally determined, the complementarity principle says that the fringes must disappear. To carry out this experiment with photons is difficult because normally the act of determining a photon's location destroys it. We propose to overcome this difficulty by putting a type-2 optical parametric amplifier (OPA) in each arm of a Mach-Zehnder interferometer, and observing fringes at the output. An OPA responds to an input photon by increasing its probability to produce a pair of photons with polarization orthogonal to the input, the detection of which allows partial inference about the path taken by the input photon without destroying it. Thus, the measurement is of the quantum nondemolition (QND) type. Author

N92-22056*# Moscow State Univ. (USSR). Dept. of Physics.
LOCALIZATION OF ONE-PHOTON STATE IN SPACE AND EINSTEIN-PODOLSKY-ROSEN PARADOX IN SPONTANEOUS PARAMETRIC DOWN CONVERSION
A. N. Penin, T. A. Reutova, and A. V. Sergienko *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 95-99 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

An experiment on one-photon state localization in space using a correlation technique in Spontaneous Parametric Down Conversion (SPDC) process is discussed. Results of measurements demonstrate an idea of the Einstein-Podolsky-Rosen (EPR) paradox for coordinate and momentum variables of photon states. Results of the experiment can be explained with the help of an advanced wave technique. The experiment is based on the idea that two-photon states of optical electromagnetic fields arising in the nonlinear process of the spontaneous parametric down conversion (spontaneous parametric light scattering) can be explained by quantum mechanical theory with the help of a single wave function. Author

N92-22057*# City Coll. of the City Univ. of New York, NY.
GENERALIZED PARAMETRIC DOWN CONVERSION, MANY PARTICLE INTERFEROMETRY, AND BELL'S THEOREM
Hyung Sup Choi *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 101-102 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

A new field of multi-particle interferometry is introduced using a nonlinear optical spontaneous parametric down conversion (SPDC) of a photon into more than two photons. The study of SPDC using a realistic Hamiltonian in a multi-mode shows that at least a low conversion rate limit is possible. The down converted field exhibits many stronger nonclassical phenomena than the usual two photon parametric down conversion. Application of the multi-particle interferometry to a recently proposed many particle Bell's theorem on the Einstein-Podolsky-Rosen problem is given. Author

N92-22058*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
GOING THROUGH A QUANTUM PHASE
Jeffrey H. Shapiro *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 107-123 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Phase measurements on a single-mode radiation field are examined from a system-theoretic viewpoint. Quantum estimation theory is used to establish the primacy of the Susskind-Glogower (SG) phase operator; its phase eigenkets generate the probability operator measure (POM) for maximum likelihood phase estimation. A commuting observables description for the SG-POM on a signal x apparatus state space is derived. It is analogous to the signal-band x image-band formulation for optical heterodyne detection. Because heterodyning realizes the annihilation operator POM, this analogy may help realize the SG-POM. The wave function representation associated with the SG POM is then used to prove the duality between the phase measurement and the number operator measurement, from which a number-phase uncertainty principle is obtained, via Fourier theory, without recourse to linearization. Fourier theory is also employed to establish the principle of number-ket causality, leading to a Paley-Wiener condition that must be satisfied by the phase-measurement probability density function (PDF) for a single-mode field in an arbitrary quantum state. Finally, a two-mode phase measurement is shown to afford phase-conjugate quantum communication at zero error probability with finite average photon number. Application of this construct to interferometric precision measurements is briefly discussed. Author

N92-22059*# Hunter Coll., New York, NY. Dept. of Physics and Astronomy.
QUADRATIC SQUEEZING: AN OVERVIEW **c32**
M. Hillery, D. Yu, and J. Bergou *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 125-135 Sponsored in part by City Univ. of NY (For primary document see N92-22045 12-74)
(Grant NSF PHY-90-00173)
Avail: NTIS HC/MF A17 CSCL 20N

The amplitude of the electric field of a mode of the electromagnetic field is not a fixed quantity: there are always quantum mechanical fluctuations. The amplitude, having both a magnitude and a phase, is a complex number and is described by the mode annihilation operator a. It is also possible to characterize the amplitude by its real and imaginary parts which correspond to the Hermitian and anti-Hermitian parts of a, X sub 1 = 1/2(a(sup +) + a) and X sub 2 = i/2(a(sup +) - a), respectively. These operators do not commute and, as a result, obey the uncertainty relation (h = 1) delta X sub 1(delta X sub 2) greater than or = 1/4. From this relation we see that the amplitude fluctuates within an 'error box' in the complex plane whose area is at least 1/4. Coherent states, among them the vacuum state, are minimum uncertainty states with delta X sub 1 = delta X sub 2 = 1/2. A squeezed state, squeezed in the X sub 1 direction, has the property that delta X sub 1 is less than 1/2. A squeezed state need not be a minimum uncertainty state, but those that are can be obtained by applying the squeeze operator. Author

N92-22060*# California Univ., Berkeley. Dept. of Physics.
QUANTUM SPATIAL PROPAGATION OF SQUEEZED LIGHT IN A DEGENERATE PARAMETRIC AMPLIFIER
Ivan H. Deutsch and John C. Garrison (Lawrence Livermore National Lab., CA.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 137-146 Previously announced as N91-30039 Sponsored in part by a Dept. of Education Scholarship (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Differential equations which describe the steady state spatial evolution of nonclassical light are established using standard quantum field theoretic techniques. A Schroedinger equation for the state vector of the optical field is derived using the quantum analog of the slowly varying envelope approximation (SVEA). The steady state solutions are those that satisfy the time independent Schroedinger equation. The resulting eigenvalue problem then leads to the spatial propagation equations. For the degenerate parametric amplifier this method shows that the squeezing parameter obey nonlinear differential equations coupled by the amplifier gain and phase mismatch. The solution to these differential equations is equivalent to one obtained from the classical three wave mixing steady state solution to the parametric amplifier with a nondepleted pump. Author

N92-22061*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
SQUEEZED PULSED LIGHT FROM A FIBER RING INTERFEROMETER
K. Bergman and H. A. Haus *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 147-161 (For primary document see N92-22045 12-74)
(Contract DAAL03-89-C-0011; DL-H-404179; NSF EET-87-00474)
Avail: NTIS HC/MF A17 CSCL 20F

Observation of squeezed noise, 5 +/- 0.3 dB below the shot noise level, generated with pulses in a fiber ring interferometer is reported. The interferometric geometry is used to separate the pump pulse from the squeezed vacuum radiation. A portion of the pump is reused as the local oscillator in a homodyne detection. The pump fluctuations are successfully subtracted and shot noise limited performance is achieved at low frequencies (35-85 KHz). A possible utilization of the generated squeezed vacuum in improving a fiber gyro's signal to noise ratio is discussed. Author

N92-22062*# California Inst. of Tech., Pasadena. Applied Physics.
EQUILIBRIUM TEMPERATURE OF LASER COOLED ATOMS IN SQUEEZED VACUUM
Y. Shevy *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 163-175 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

It is shown that by squeezing the vacuum fluctuations of the electromagnetic field the quantum fluctuations of the optical forces exerted on laser cooled two-level atoms, can be dramatically modified. Under certain conditions, this modification in concert with the enhanced average forces can lead to equilibrium temperatures below those attained under normal vacuum fluctuations. Author

N92-22063*# Massachusetts Inst. of Tech., Cambridge.
ON THE MEASUREMENT OF TIME FOR THE QUANTUM HARMONIC OSCILLATOR **c77**
Scott R. Shepard *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 177-179 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

A generalization of previous treatments of quantum phase is presented. Restrictions on the class of realizable phase statistics are thereby removed; thus, permitting 'phase wavefunction collapse' (and other advantages). This is accomplished by exciting the auxiliary mode of the measurement apparatus in a time-reversed fashion. The mathematical properties of this auxiliary mode are studied in the hope that they will lead to an identification of a physical apparatus which can realize the quantum phase measurement. Author

N92-22064*# Imperial Coll. of Science and Technology, London (England). Optics Section.
THE ORIGIN OF NON-CLASSICAL EFFECTS IN A ONE-DIMENSIONAL SUPERPOSITION OF COHERENT STATES
V. Buzek, P. L. Knight, and A. Vidiella Barranco *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 181-193 Sponsored in part by UK Science and Engineering Research Council (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

We investigate the nature of the quantum fluctuations in a light field created by the superposition of coherent fields. We give a physical explanation (in terms of Wigner functions and phase-space interference) why the 1-D superposition of coherent states in the direction of the x-quadrature leads to the squeezing of fluctuations in the y-direction, and show that such a superposition can generate the squeezed vacuum and squeezed coherent states. Author

N92-22065*# Academy of Sciences (USSR), Moscow. Lebedev Physical Inst.
LIMITATIONS ON SQUEEZING AND FORMATION OF THE SUPERPOSITION OF TWO MACROSCOPICALLY DISTINGUISHABLE STATES AT FUNDAMENTAL FREQUENCY IN THE PROCESS OF SECOND HARMONIC GENERATION **c77**
S. P. Nikitin and A. V. Masalov *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 195-197 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

The results of numerical simulations of quantum state evolution in the process of second harmonic generation (SHG) are discussed. It is shown that at a particular moment of time in the fundamental mode initially coherent state turns into a superposition of two macroscopically distinguished states. The question of whether this superposition exhibits quantum interference is analyzed. Author

N92-22066*# Academy of Sciences (USSR), Moscow. Lebedev Physics Inst.
FIELD QUANTIZATION AND SQUEEZED STATES GENERATION IN RESONATORS WITH TIME-DEPENDENT PARAMETERS **c32**
V. V. Dodonov, A. B. Klimov, and D. E. Nikonov *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 199-215 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20N

The problem of electromagnetic field quantization is usually considered in textbooks under the assumption that the field occupies some empty box. The case when a nonuniform time-dependent dielectric medium is confined in some space region with time-dependent boundaries is studied. The basis of the subsequent consideration is the system of Maxwell's equations in linear passive time-dependent dielectric and magnetic medium without sources. Author

N92-22067*# Sogang Univ., Seoul (Republic of Korea). Dept. of Physics.
RADIATION FORCE ON A SINGLE ATOM IN A CAVITY **c72**
M. S. Kim *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 217-224 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20H

We consider the radiation pressure microscopically. Two perfectly conducting plates are parallelly placed in a vacuum. As the vacuum field hits the plates they get pressure from the vacuum. The excessive outside modes of the vacuum field push the plates together, which is known as the Casimer force. We investigate the quantization of the standing wave between the plates to study the interaction between this wave and the atoms on the plates or between the plates. We show that even the vacuum field pushes the atom to place it at nodes of the standing wave. Author

N92-22068*# Australian National Univ., Canberra. Dept. of Physics and Theoretical physics.
SQUEEZED LIGHT FROM CONVENTIONALLY PUMPED MULTI-LEVEL LASERS **c36**
T. C. Ralph and C. M. Savage *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 225-227 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20E

We have calculated the amplitude squeezing in the output of several conventionally pumped multi-level lasers. We present results which show that standard laser models can produce significantly squeezed outputs in certain parameter ranges. Author

N92-22069*# Arkansas Univ., Fayetteville. Dept. of Physics.
STATISTICAL PROPERTIES OF SQUEEZED BEAMS OF LIGHT GENERATED IN PARAMETRIC INTERACTIONS
Reeta Vyas *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 229-231 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Fluctuation properties of squeezed photon beams generated in three wave mixing processes such as second harmonic generation, degenerate and nondegenerate parametric oscillations, and homodyne detection are studied in terms of photon sequences recorded by a photodetector. Author

N92-22070*# Moscow State Univ. (USSR). Dept. of Physics.
NONDESTRUCTIVE MEASUREMENT OF INTENSITY OF OPTICAL FIELDS USING SPONTANEOUS PARAMETRIC DOWN CONVERSION
A. N. Penin, G. Kh. Kitaeva, and A. V. Sergienko *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 233-236 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20F

Results of nondestructive measurements of intensity (photons per mode) of light from different sources are discussed. The procedure of measurement does not destroy the state of the optical field. The method is based on using the second order nonlinearity of crystal media lacking a center of symmetry and the nonclassical properties of the process of Spontaneous Parametric Down Conversion (SPDC). Author

N92-22071*# Australian National Univ., Canberra. Dept. of Physics and Theoretical Physics.
SHORT-CAVITY SQUEEZING IN BARIUM **c72**
D. M. Hope, H-A. Bachor, P. J. Manson, and D. E. McClelland *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 237-239 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20H

Broadband phase sensitive noise and squeezing were experimentally observed in a system of barium atoms interacting with a single mode of a short optical cavity. Squeezing of 13 +/- 3 percent was observed. A maximum possible squeezing of 45 +/- 8 percent could be inferred for out experimental conditions, after correction for measured loss factors. Noise reductions below the quantum limit were found over a range of detection frequencies 60-170 MHz and were best for high cavity transmission and large optical depths. The amount of squeezing observed is consistent with theoretical predictions from a full quantum statistical model of the system. Author

N92-22072*# Georgia Inst. of Tech., Atlanta. School of Physics.
AMPLITUDE SQUEEZED LIGHT FROM A LASER **c36**
D. L. Hart and T. A. B. Kennedy *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 241-243 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20E

Intensity squeezed light was successfully generated using semiconductor lasers with sub-Poissonian pumping. Control of the pumping statistics is crucial and is achieved by a large series resistor which regulates the pump current; its sub-Poissonian statistics are then transferred to the laser output. The sub-Poissonian pumping of other laser systems is not so simple, however, and their potential as squeezed states sources is apparently diminished. We consider a conventional laser incoherently pumped well above threshold, and allow for pump depletion of the ground state. In this regime, sub-Poissonian photon statistics and squeezed amplitude fluctuations are produced. Author

N92-22073*# Bell Telephone Labs., Inc., Murray Hill, NJ.
SQUEEZED STATES AND PATH INTEGRALS **c77**
Ingrid Daubechies and John R. Klauder (Florida Univ., Gainesville.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 247-259 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

The continuous-time regularization scheme for defining phase-space path integrals is briefly reviewed as a method to define a quantization procedure that is completely covariant under all smooth canonical coordinate transformations. As an illustration of this method, a limited set of transformations is discussed that have an image in the set of the usual squeezed states. It is noteworthy that even this limited set of transformations offers new possibilities for stationary phase approximations to quantum mechanical propagators. Author

N92-22074*# Indiana Univ., Bloomington. Dept. of Physics.
SUPERCOHERENT STATES AND PHYSICAL SYSTEMS **c77**
B. W. Fatyga, V. Alan Kostelecky, Michael Martin Nieto, and D. Rodney Truax (Calgary Univ., Alberta) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 261-267 Previously announced as N91-30040 Sponsored in part by National Sciences

and Engineering Research Council of Canada (For primary document see N92-22045 12-74)
(Contracts DE-AC02-84ER-40125; W-7405-eng-36)
Avail: NTIS HC/MF A17 CSCL 20C

A method is developed for obtaining coherent states of a system admitting a supersymmetry. These states are called supercoherent states. The presented approach is based on an extension to supergroups of the usual group-theoretic approach. The example of the supersymmetric harmonic oscillator is discussed, thereby illustrating some of the attractive features of the method. Supercoherent states of an electron moving in a constant magnetic field are also described. Author

N92-22075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SQUEEZED STATES, TIME-ENERGY UNCERTAINTY RELATION, AND FEYNMAN'S REST OF THE UNIVERSE **c77**
D. Han, Y. S. Kim, and Marilyn E. Noz (New York Univ., New York.) *In its* Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 269-282 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

Two illustrative examples are given for Feynman's rest of the universe. The first example is the two-mode squeezed state of light where no measurement is taken for one of the modes. The second example is the relativistic quark model where no measurement is possible for the time-like separation fo quarks confined in a hadron. It is possible to illustrate these examples using the covariant oscillator formalism. It is shown that the lack of symmetry between the position-momentum and time-energy uncertainty relations leads to an increase in entropy when the system is different Lorentz frames. Author

N92-22076*# Missouri Univ., Columbia. Dept. of Physics and Astronomy.
WAVELETS AND THE SQUEEZED STATES OF QUANTUM OPTICS
B. DeFacio *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 283-296 (For primary document see N92-22045 12-74)
(Grant AF-AFOSR-0307-90)
Avail: NTIS HC/MF A17 CSCL 20F

Wavelets are new mathematical objects which act as 'designer trigonometric functions.' To obtain a wavelet, the original function space of finite energy signals is generalized to a phase-space, and the translation operator in the original space has a scale change in the new variable adjoined to the translation. Localization properties in the phase-space can be improved and unconditional bases are obtained for a broad class of function and distribution spaces. Operators in phase space are 'almost diagonal' instead of the traditional condition of being diagonal in the original function space. These wavelets are applied to the squeezed states of quantum optics. The scale change required for a quantum wavelet is shown to be a Yuen squeeze operator acting on an arbitrary density operator. Author

N92-22077*# Liege Univ. (Belgium). Physique Theorique et Mathematique.
COHERENT STATES AND PARASUPERSYMMETRIC QUANTUM MECHANICS **c77**
Nathalie Debergh *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 297-298 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

It is well known that Parafermi and Parabose statistics are natural extensions of the usual Fermi and Bose ones, enhancing trilinear (anti)commutation relations instead of bilinear ones. Due to this generalization, positive parameters appear: the so-called orders of paraquantization p (= 1, 2, 3, ...) and h sub 0 (= 1/2, 1, 3/2, ...), respectively, the first value leading in each case to the usual statistics. The superpostion of the parabosonic and parafermionic operators gives rise to parasupermultiplets for which mixed trilinear relations have already been studied leading to two (nonequivalent) sets: the relative Parabose and the relative Parafermi ones. For the specific values p = 1 = 2h sub 0, these sets reduce to the well known supersymmetry. Coherent states associated with this last model have been recently put in evidence through the annihilation operator point of view and the group theoretical approach or displacement operator context. We propose to realize the corresponding studies within the new context p = 2 = 2h sub 0, being then directly extended to any order of paraquantization. Author

N92-22078*# Ulm Univ. (Germany, F.R.). Abteilung fuer Theoretische Physik 3.
A GAUSSIAN MEASURE OF QUANTUM PHASE NOISE **c77**
Wolfgang P. Schleich and Jonathan P. Dowling (Army Missile Command, Redstone Arsenal, AL.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 299-309 Prepared in cooperation with Max-Planck-Inst. fuer Quantenoptik, Garching, Fed. Republic of Germany (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

We study the width of the semiclassical phase distribution of a quantum state in its dependence on the average number of photons (m) in this state. As a measure of phase noise, we choose the width, delta phi, of the best Gaussian approximation to the dominant peak of this probability curve. For a coherent state, this width decreases with the square root of (m), whereas for a truncated phase state it decreases linearly with increasing (m). For an optimal phase state, delta phi decreases exponentially but so does the area caught underneath the peak: all the probability is stored in the broad wings of the distribution. Author

N92-22079*# Pavia Univ. (Italy). Dipt. di Fisica.
IDEAL PHOTON NUMBER AMPLIFIER AND DUPLICATOR **c77**
G. M. DAriano *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 311-326 Sponsored in part by Ministero dell'Universita e della Ricerca Scientifica e Tecnologica (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

The photon number-amplification and number-duplication mechanism are analyzed in the ideal case. The search for unitary evolutions leads to consider also a number-deamplification mechanism, the symmetry between amplification and deamplification being broken by the integer-value nature of the number operator. Both transformations, amplification and duplication, need an auxiliary field which, in the case of amplification, turns out to be amplified in the inverse way. Input-output energy conservation is accounted for using a classical pump or through frequency-conversion of the fields. Ignoring one of the fields is equivalent to considering the amplifier as an open system involving entropy production. The Hamiltonians of the ideal devices are given and compared with those of realistic systems. Author

N92-22080*# California Univ., Santa Barbara. Dept. of Physics.
DECOHERENCE IN QUANTUM MECHANICS AND QUANTUM COSMOLOGY **c77**
James B. Hartle *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 327-328 (For primary document see N92-22045 12-74)
(Grant NSF PHY-90-08502)
Avail: NTIS HC/MF A17 CSCL 20C

A sketch of the quantum mechanics for closed systems adequate for cosmology is presented. This framework is an extension and clarification of that of Everett and builds on several aspects of the post-Everett development. It especially builds on the work of Zeh, Zurek, Joos and Zeh, and others on the interactions of quantum systems with the larger universe and on the ideas of Griffiths, Omnes, and others on the requirements for consistent probabilities of histories. Author

N92-22081*# Colorado Univ., Boulder.
SQUEEZED STATES IN THE THEORY OF PRIMORDIAL GRAVITATIONAL WAVES **c77**
Leonid P. Grishchuk *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 329-338 Prepared in cooperation with Sternberg Astronomical Inst., Moscow, USSR (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

It is shown that squeezed states of primordial gravitational waves are inevitably produced in the course of cosmological evolution. The theory of squeezed gravitons is very similar to the theory of squeezed light. Squeezed parameters and statistical properties of the expected relic gravity-wave radiation are described. Author

N92-22082*# Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Mathematics and Statistics.
SQUEEZED STATES: A GEOMETRIC FRAMEWORK **c77**
S. T. Ali, J. A. Brooke, and J.-P. Gazeau (Paris VII Univ., France) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 339-341 Prepared in cooperation with Saskatchewan Univ., Saskatoon Sponsored in part by National Science and Engineering Research Council (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

A general definition of squeezed states is proposed and its main features are illustrated through a discussion of the standard optical coherent states represented by 'Gaussian pure states'. The set-up involves representations of groups on Hilbert spaces over homogeneous spaces of the group, and relies on the construction of a square integrable (coherent state) group representation modulo a subgroup. This construction depends upon a choice of a Borel section which has a certain permissible arbitrariness in its selection; this freedom is attributable to a squeezing of the defining coherent states of the representation, and corresponds in this way to a sort of gauging. Author

N92-22083*# Vanderbilt Univ., Nashville, TN. Dept. of Physics and Astronomy.
WORMHOLES AND NEGATIVE ENERGY FROM THE GRAVITATIONALLY SQUEEZED VACUUM **c77**
David Hochberg *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 343-345 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

Minkowski-signature wormhole solutions of the Einstein field equations require the existence of negative energy density in the vicinity of their throats. We point out that the gravitational interaction automatically generates squeezed vacuum states of matter, which by their nature, entail negative energy and, thus, provide a natural source for maintaining this class of wormholes. Author

N92-22084*# Chungbuk National Univ. (Republic of Korea). Dept. of Physics.
EXACT SOLUTION OF A QUANTUM FORCED TIME-DEPENDENT HARMONIC OSCILLATOR **c77**
Kyu Hwang Yeon, Thomas F. George, and Chung In Um (Korea Univ., Seoul, Republic of Korea) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 347-363 Previously announced as N91-28812 Sponsored in part by Korea Science and Engineering Foundation; Basic Science Research Inst., Ministry of Education; and Navy (For primary document see N92-22045 12-74)
(Grant NSF CHE-90-16789)
Avail: NTIS HC/MF A17 CSCL 20C

The Schrodinger equation is used to exactly evaluate the propagator, wave function, energy expectation values, uncertainty values, and coherent state for a harmonic oscillator with a time dependent frequency and an external driving time dependent force. These quantities represent the solution of the classical equation of motion for the time dependent harmonic oscillator. Author

N92-22085*# Alabama A & M Univ., Normal. Dept. of Physics.
NONCLASSICAL DEPTH OF A QUANTUM STATE **c77**
Ching Tsung Lee *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 365-367 (For primary document see N92-22045 12-74)
(Contract N00014-89-J-1050)
Avail: NTIS HC/MF A17 CSCL 20C

A measure is defined for how nonclassical a quantum state is, with values ranging from 0 to 1. When it is applied to the photon-number states, the calculated value is 1, the maximum possible. For squeezed states, it is a monotonically increasing function of the squeeze parameter with values varying from 0 to 1/2. The physical meaning of the nonclassical depth is found to be just the number of thermal photons necessary to ruin the nonclassical nature of the quantum state. Author

N92-22086*# European Nuclear Energy Agency, Frascati (Italy). Dip. Sviluppo Tecnologie di Punta.
TOWARDS A WAVE THEORY OF CHARGED BEAM TRANSPORT: A COLLECTION OF THOUGHTS **c77**
G. Dattoli, C. Mari, and A. Torre *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 369-375 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

We formulate in a rigorous way a wave theory of charged beam linear transport. The Wigner distribution function is introduced and provides the link with classical mechanics. Finally, the von Neumann equation is shown to coincide with the Liouville equation for the nonlinear transport. Author

N92-22087*# Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. for Theoretical Physics.
ENTROPIC UNCERTAINTY RELATION AT FINITE TEMPERATURE **c77**
Sumiyoshi Abe and Norikazu Suzuki (Max-Planck-Inst. fuer Kernphysik, Heidelberg, Germany, F.R.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 377-379 Prepared in cooperation with Nihon Univ., Tokyo, Japan Sponsored in part by Alexander von Humboldt Foundation (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

We discussed how much information is lost when a particle is in equilibrium with the thermal reservoir of temperature T = 1/beta. The universal temperature correction to the r.h.s. of U(X,P:psi) greater than or = 1 + ln(pi) is determined. For this purpose, it is convenient to employ the framework of thermo-field dynamics (TFD). This formulation of finite-temperature (T not = 0) quantum theory utilizes the doubled Hilbert space, the normal operator (A) acting on the objective space, and its corresponding tildian operator on the fictitious space. The physical probability density associated with the measurement of the normal operator, A, is given, and the information entropy at T not = 0 is defined. The results describe how the thermal disturbance effects in S sub X or S sub P (delta X or delta P) can be suppressed by squeezing with keeping U = S sub X + S sub P (delta X x delta P) its minimum value. Author

N92-22088*# General Electric Co., Moorestown, NJ. Government Electronic Systems Div.
THE HAMILTONIAN STRUCTURE OF DIRAC'S EQUATION IN TENSOR FORM AND ITS FERMI QUANTIZATION **c67**
Frank Reifler and Randall Morris *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 381-383 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 12A

Currently, there is some interest in studying the tensor forms of the Dirac equation to elucidate the possibility of the constrained tensor fields admitting Fermi quantization. We demonstrate that the bispinor and tensor Hamiltonian systems have equivalent Fermi

quantizations. Although the tensor Hamiltonian system is noncanonical, representing the tensor Poisson brackets as commutators for the Heisenberg operators directly leads to Fermi quantization without the use of bispinors. Author

N92-21266*# Military Academy, West Point, NY. Dept. of Physics.
OPTICAL CORRELATION Final Report
Steven S. Cotariu *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 12 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N92-21071# Lawrence Livermore National Lab., CA.
DIAGNOSTICS FOR INERTIAL CONFINEMENT FUSION RESEARCH
L. W. Coleman 1 Nov. 1991 16 p Presented at the International School of Plasma Physics Piero Caldirola' Diagnostics for Contemporary Fusion Experiments, Varenna (Italy), 27 Aug. - 6 Sep. 1991
(Contract W-7405-eng-48)
(DE92-006890; UCRL-JC-108079; CONF-910857-8) Avail: NTIS HC/MF A03

A central challenge for the diagnosis of ICF experiments lies in their characteristically small spatial and temporal time scales. Typically phenomena of interest occur over spatial scales from microns up to a few millimeters and time scales from several picoseconds up to several nanoseconds. The plasma density regimes of interest range from approximately 10(exp 20) cm(exp -3) in the low density corona outside the ablation surface of an imploding capsule to approximately 10(exp 26) cm(exp -3) in the compressed fuel core. The diagnostics goals for ICF are to develop and utilize instruments and techniques capable of resolutions on a micron and picosecond scale for a variety of types of measurements applicable to different regions in this plasma density range. The range of photon energies of interest in ICF ranges from 1 eV (the output of a Nd:glass laser) up to approximately 100 keV (the energy of some suprathermal x-rays that can sometimes be produced in laser-plasma interactions). Measurements of neutrons from 2.5 MeV (DD reactions) up to approximately 30 MeV ('suprathermal' DT tertiary reactions) need to be made. This paper discusses progress in the diagnostics of these ranges. DOE

N92-21078# General Atomic Co., San Diego, CA.
RECENT RESULTS FROM D3-D AND FUTURE PLANS
T. C. Simonen Nov. 1991 9 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contracts DE-AC03-89ER-51114; W-7405-eng-48; DE-AC03-89ER-52153; DE-AC05-84OR-21400)
(DE92-007631; GA-A-20711; CONF-910968-67) Avail: NTIS HC/MF A02

This paper summarizes recent DIII-D tokamak experimental results, describes new hardware being implemented to carry out the DIII-D 1990's tokamak research program, and discusses their implications for engineering designs for next generation tokamaks, such as ITER. DOE

N92-21082# General Atomic Co., San Diego, CA.
AN EDGE DENSITY FLUCTUATION DIAGNOSTIC FOR DIII-D USING LITHIUM BEAMS
D. M. Thomas Dec. 1991 9 p
(Contract DE-FG03-90ER-54081)
(DE92-008190; GA-C-20806) Avail: NTIS HC/MF A02

This report covers the research conducted under DOE grant FG03-90ER-081 during the period August 15, 1990 through November 15, 1991. Progress during the period March 15, 1990 through August 15, 1990 was covered in a previous report. Highlights during this period include the development of a compact neutral lithium accelerator capable of producing several mA at up to 30 kV, measurements of intrinsic beam fluctuation levels, and the design and partial completion of the diagnostic installation on the D3-D tokamak. We also had one journal article describing the system published in Reviews of Scientific Instruments, presented a poster on our recent progress at the APS Plasma Physics conference, and submitted an abstract to the 9th Topical Conference on Plasma Diagnostics. The overall objective of this project is to provide detailed information about the behavior of the electron density in the edge region of D3-D, and in particular to examine the local character of the associated degradation in confinement properties. Measurements should provide important data for testing theories of the L-H transition in tokamaks and should help in assessing the role of various instabilities in anomalous transport. The work on this project may be naturally organized according to the following six subareas: Ion source/beam system, neutralizer system, optical system, data acquisition, data analysis, and machine (D3-D) interface. Progress in each of these areas will be discussed briefly. We also briefly discuss our plans for future work on this program. DOE

N92-21101# Lawrence Livermore National Lab., CA.
PROCEEDINGS PAPER: THREE-WAVE PARAMETRIC INSTABILITIES IN LONG-SCALE-LENGTH, SOMEWHAT-PLANAR, LASER-PRODUCED PLASMAS
R. P. Drake 1 Nov. 1991 6 p Presented at the European Conference on Laser Interaction With Matter (ECLIM), Warsaw (Poland), 21-25 Oct. 1991
(Contract W-7405-eng-48)
(DE92-006895; UCRL-JC-107792; CONF-9110326-1) Avail: NTIS HC/MF A02

Three-wave parametric instabilities, in which an incident, laser-light wave (a pump) resonantly decays into two decay waves, have long been recognized to potentially play a large role in the physics of laser-produced plasmas. Many effects have been predicted, but only gradually and with difficulty have experiments developed the ability to observe some of them. One obstacle has been that the behavior of the instabilities often depends upon the scale-length and planarity of the plasma. My collaborators and I have for several years worked to overcome this specific obstacle, and when necessary now work routinely with plasmas that are thousands of laser wavelengths in the axial and transverse scale lengths of the plasma parameters. This has allowed us to report the first observations of some instabilities and to study the scaling behavior of several instabilities as well. DOE

N92-21122# Lawrence Livermore National Lab., CA.
HIGH RESOLUTION XUV SPECTROSCOPY OF X RAY LASER PLASMAS
J. A. Koch, M. R. Carter, L. B. DaSilva, B. J. MacGowan, D. L. Matthews, S. Mrowka, J. H. Scofield, G. Shimkaveg, R. S. Walling, and P. J. Batson et al Sep. 1991 9 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contracts W-7405-eng-48; DE-AC03-76SF-00098)
(DE92-007350; UCRL-JC-108078; CONF-9107115-65) Avail: NTIS HC/MF A02

This paper discusses recent progress in LLNL's high resolution XUV spectroscopy efforts with x-ray laser plasmas. We describe the instrumentation used, and we present preliminary time-resolved data on the spectral profiles of several XUV (extreme ultraviolet) lines from Ne-like Se and Ne-like Y x-ray lasers which have been obtained with instrumental resolutions (lambda/delta(lambda)) of approximately 10,000. The Se data indicates that the 206.4 A J = 2-1 laser line narrows below the expected 400 eV Doppler width (35 mA) when amplified through approximately 6 gain lengths, while the Y data shows no evidence of the J = 0-1 laser predicted to be nearly resonant with the J = 2-1 laser at 154.9 A. DOE

N92-21130# Sydney Univ. (Australia). School of Physics.
WILLS PLASMA PHYSICS DEPARTMENT ANNUAL REPORT, 1989
1991 48 p
(DE92-612323; INIS-MF-13035) Avail: NTIS HC/MF A03

An overview of the collaborative researches carried out during 1989 at the Wills Plasma Physics Department is given. The main activities included the study of hydromagnetic surface waves and resonance frequency heating using the TORTUS tokamak; the development of diagnostic techniques, particularly those based on submillimetre lasers and tunable gyrotrons; gas discharge studies and investigations of apparent cold nuclear fusion in deuterated palladium. The small research tokamak TORTUS was upgraded during the year, thus enabling the machine to be routinely and reliably operated at toroidal currents around 40 kA. A list of papers published or presented at various conferences during the year is included in the appendix. DOE

N92-21141# Texas Univ., Austin. Inst. for Fusion Studies.
COMPARISONS OF THEORETICALLY PREDICTED TRANSPORT FROM ION TEMPERATURE GRADIENT INSTABILITIES TO L-MODE TOKAMAK EXPERIMENTS
M. Kotschenreuther, H. V. Wong, P. L. Lyster, H. L. Berk, R. Denton, W. H. Miner, and P. Valanju Dec. 1991 14 p
(Contract DE-FG05-80ET-53088)
(DE92-006881; DOE/ET-53088/532; IFSR-532) Avail: NTIS HC/MF A03

The theoretical transport from kinetic micro-instabilities driven by ion temperature gradients in a sheared slab is compared to experimentally inferred transport in L-mode tokamaks. Low noise gyrokinetic simulation techniques are used to obtain the ion thermal transport coefficient X. This X is much smaller than in experiments, and so cannot explain L-mode confinement. Previous predictions based on fluid models gave much greater X than experiments. Linear and nonlinear comparisons with the fluid model show that it greatly overestimates transport for experimental parameters. In addition, disagreements among previous analytic and simulation calculations of X in the fluid model are reconciled. DOE

N92-21142# Texas Univ., Austin. Inst. for Fusion Studies.
DRIFT WAVE VORTICES IN NONUNIFORM PLASMAS WITH SHEARED MAGNETIC FIELDS
X. N. Su, W. Horton, and P. J. Morrison Nov. 1991 29 p
(Contract DE-FG05-80ET-53088)
(DE92-006879; DOE/ET-53088/523; IFSR-523) Avail: NTIS HC/MF A03

Nonlinear coherent structures governed by the coupled drift wave-ion acoustic mode equations in nonuniform plasmas with sheared magnetic fields are studied analytically and numerically. A solitary vortex equation that includes the effects of density and temperature gradients, and magnetic shear is derived and analyzed. The analytic and numerical studies show that for a plasma in a sheared magnetic field, even without the temperature and drift velocity gradients, solitary vortex solutions are possible; however, these solutions are not exponentially localized due to the presence of a nonstructurally stable perturbative tail that connects to the core of the vortex. The new coherent vortex structures are dipole-like in their symmetry, but are not the modons of Larichev and Reznik. In the presence of a small temperature or drift velocity gradient, the new shear-induced dipole can not survive and will separate into monopoles, like the case of the modon in a sheared drift velocity as studied in Su et al. The solitary solutions are found from the nonlinear eigenvalue problem for the effective potential in a quasi-one-dimensional approximation. The numerical simulations are performed in 2-D with the coupled vorticity and parallel mass flow equations. DOE

N92-21595# Oak Ridge National Lab., TN.
HELIUM TRANSPORT AND EXHAUST IN TOKAMAKS
J. T. Hogan and D. L. Hillis Dec. 1991 36 p Presented at the International Workshop on Helium Transport and Exhaust Experiments, Gatlinburg, TN, 16-18 Apr. 1991
(Contract DE-AC05-84OR-21400)
(DE92-007805; ORNL/TM-11935; ITER/US-91/PH-13-02) Avail: NTIS HC/MF A03

A workshop on helium transport and exhaust in tokamaks was held in Gatlinburg, Tennessee, April 6 to 18, 1991. The chief purpose of the workshop was to foster discussion of plans for future experiments in the study of adequate helium removal from advanced fusion devices such as the International Thermonuclear Engineering Reactor (ITER). The areas covered at the workshop are outlined, and the results presented are discussed in detail. DOE

N92-21708# General Atomic Co., San Diego, CA.
RECYCLING AND PARTICLE CONTROL IN DIII-D
G. L. Jackson Nov. 1991 25 p Presented at the 38th National Symposium of the American Vacuum Society, Seattle, WA, 11-15 Nov. 1991
(Contract DE-AC03-89ER-51114)
(DE92-007944; GA-A-20743; CONF-911132-20) Avail: NTIS HC/MF A03

Particle control of both hydrogen and impurity atoms is important in obtaining reproducible discharges with a low fraction of radiated power in the DIII-D tokamak. The main DIII-D plasma facing components are graphite tiles and Inconel. Hydrogenic species desorbed from graphite during a tokamak discharge can be a major fueling source, especially in unconditioned graphite where these species can saturate the surface regions. In this case the recycling coefficient can exceed unity, leading to an uncontrolled density rise. In addition to removing volatile hydrocarbons and oxygen, DIII-D vessel conditioning efforts have been directed at the reduction of particle fueling from the graphite tiles. Conditioning techniques include: baking to less than or = 400 C, low power pulsed discharge cleaning, and glow discharges in deuterium, helium, neon, or argon. Helium glow wall conditioning, is now routinely performed before every tokamak discharge. The effects of these techniques on hydrogen recycling and impurity influxes will be presented. The Inconel walls, while not generally exposed to high heat fluxes, nevertheless represent a source of metal impurities which can lead to impurity accumulation in the discharge and a high fraction of radiated power, particularly in H-mode discharges at higher plasma currents, I sub p greater than 1.5 MA. To reduce metal influx a thin (approx. 100 nm) low Z film has been applied on all plasma facing surfaces in DIII-D. The application of the boron film, referred to as boronization has the additional benefit over a carbon film of further reducing the oxygen influx. Following the first boronization in DIII-D a regime of very high confinement (VH-mode) was observed, characterized by low ohmic target density, low Z(sub eff), and low radiated power. DOE

N92-21817# Lawrence Livermore National Lab., CA.
ABLATION GAS DYNAMICS OF LOW-Z MATERIALS ILLUMINATED BY SOFT X RAYS
S. P. Hatchett Sep. 1991 25 p Presented at the Inertial Fusion Lecture Series, Princeton, NJ, Apr. 1991
(Contract W-7405-eng-48)
(DE92-006882; UCRL-JC-108348; CONF-9104331-1) Avail: NTIS HC/MF A03

Though many of our results will have much greater generality, the main purpose of this paper is to provide a simple, accurate, physical theory of what happens when a Planckian spectrum of soft x rays is incident on one side of the slab of initially cold, dense material, of small nuclear charge Z. Our approach will be to consider in some detail the idealized situation. A semi-infinite (x less than or = 0) slab of initially cold (T less than 300 K), dense (rho approx. 1 to 10 g/cc), low-Z (Z less than 5) material is suddenly subjected at time t = 0 and thereafter to radiation incoming from x = +(infinity) with a specific intensity in directions toward the slab that is Planckian, characterized by a blackbody temperature, T(sub R) in the soft x ray region. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N92-21076# Brookhaven National Lab., Upton, NY.
X RAY SCATTERING STUDIES OF MULTILAYER INTERFACES
M. K. Sanyal, S. K. Sinha, A. Gibaud, S. K. Satija, C. F. Majkrzak, and H. Homma 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007612; BNL-45048; CONF-911202-53) Avail: NTIS HC/MF A01

The results of specular and diffuse x-ray scattering studies of multilayers are discussed. We show here that such studies can yield detailed statistical information about the interfacial roughness and morphology. Results on a GaAs/AlAs multilayer are presented and the data is analyzed within the Born approximation. DOE

N92-21077# Brookhaven National Lab., Upton, NY.
ELECTROCHEMICALLY INDUCED RECONSTRUCTION OF THE Au(001) SURFACE: AN X RAY SCATTERING STUDY
B. M. Ocko and Jia Wang 1991 9 p Presented at the Workshop on Structural Effects, Cleveland, OH, 29 Oct. - 1 Nov. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007613; BNL-45045; CONF-9110242-3) Avail: NTIS HC/MF A02

In-situ x-ray specular reflectivity and glancing incident angle x-ray diffraction measurements have been performed in the Au(001) surface in two solutions under potential control in an electrochemical cell. In both the 0.01 M HCl0(sub 4) and 0.01 M KBr solutions, a '(5 x 20)' reconstruction is formed at sufficient negative potentials. The reconstruction is similar to that obtained for the clean surface in vacuum. DOE

N92-21080# Virginia Univ., Charlottesville. Dept. of Physics.
AMPLITUDE MODULATION OF CHARGE-DENSITY-WAVE DOMAINS IN 1T-TaS2 AT 300 K
R. V. Coleman, W. W. McNairy, and C. G. Slough 1991 16 p
(Contract DE-FG05-84ER-45072)
(DE92-007711; DOE/ER-45072/46) Avail: NTIS HC/MF A03

Measurements of the charge-density-wave (CDW) amplitude modulation in 1T-TaS2 at room temperature have been made using a scanning tunneling microscope (STM) operating in the constant current mode. The amplitude profiles are in good agreement with the profile predicted by the CDW domain model of Nakanishi and Shiba. Interference effects between the atomic and CDW lattices have been analyzed and do not modify these profiles significantly. They represent the true CDW amplitude variation connected with the CDW domain structure. DOE

N92-21121# International Centre for Theoretical Physics, Trieste (Italy).
PHASE TRANSITION IN 4-6 COMPOUND SEMICONDUCTORS AT HIGH PRESSURES
D. C. Gupta and R. K. Singh Sep. 1991 17 p
(DE92-614534; IC-91/286) Avail: NTIS HC/MF A03

The high pressure phase transitions, the equation of state, and associated volume collapses of IV - VI compound semiconductors have been analyzed by means of a three-body potential (TBP) model approach. The charge-transfer effects, arising from the overlapping or deformation of the electron shells of the adjacent ions leading to the many-body (three-body) interactions, are included explicitly in the crystal potential. The TBP model explains successfully the large Cauchy-discrepancy in these IV-VI semiconductors. The agreement between the present theoretical and available experimental values on the phase transition pressures (P(sub t) = 196, 148, 108, and 226 kbar), cohesive energy, and lattice parameters are in reasonably good agreement in almost all the materials under consideration. The charge-transfer effect shows an appreciable influence on the phase transition properties of these materials. DOE

N92-21125# Oak Ridge National Lab., TN.
THE ELASTIC, PLASTIC, AND TIME DEPENDENT PROPERTIES OF THIN FILMS AS DETERMINED BY ULTRA LOW LOAD INDENTATION
B. N. Lucas and W. C. Oliver 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-007700; CONF-911202-58) Avail: NTIS HC/MF A01

Using a highly spatially resolved mechanical properties microprobe, the elastic, plastic and time dependent mechanical properties of sapphire and a 1.9 micron amorphous alumina film on a sapphire substrate have been studied. Young's modulus, hardness, and stress-exponent data are reported. The technique for characterizing time dependent properties via indentation (hardness versus displacement rate/displacement) are directly compared to standard uniaxial compressive techniques (stress vs strain rate) for a bulk Pb-In alloy to further quantify the relationships between the two techniques. DOE

N92-21138# Oak Ridge National Lab., TN.
PICOSECOND NONLINEAR OPTICAL RESPONSE OF COPPER CLUSTERS CREATED BY ION IMPLANTATION IN FUSED SILICA
R. H. Magruder, III, R. F. Haglund, Jr., L. Yang, J. E. Wittig, K. Becker (Vanderbilt Univ., Nashville, TN.), and R. A. Zuhr 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006855; CONF-911202-42) Avail: NTIS HC/MF A02

We have embedded nm-size Cu clusters in optically dense, thin (approx. 150 nm) layers using standard ion implantation techniques. The size and size distribution of the clusters can be altered by varying such ion implantation parameters as total dose and current density. The layers exhibit both a thermo-optic and an electronic nonlinear optical response, depending on the mode of laser excitation. The electronic nonlinearity has a response time no longer than 5 ps. DOE

N92-21145# Lawrence Livermore National Lab., CA.
STRUCTURAL FEATURES IN ICOSAHEDRAL Al63Cu25Fe12
R. H. Howell, F. Solal, P. E. A. Turchi, C. Berger, and Y. Calvayrac (Centre National de la Recherche Scientifique, Vitry, France) 20 Aug. 1991 6 p Presented at the 9th International Conference on Positron Annihilation, Szombathely (Hungary), 26-31 Aug. 1991
(Contract W-7405-eng-48)
(DE92-006902; UCRL-JC-105980; CONF-9108150-4) Avail: NTIS HC/MF A02

Since the discovery of a quasicrystalline phase in Al-Mn alloys a substantial amount of work has been done to understand the structural and physical properties of this new class of materials. More recently the discovery of a thermodynamically stable icosahedral phase in AlCuFe presents the opportunity to study pure quasicrystalline phases of high structural quality by eliminating known defects, especially phason disorder by conventional heat treatment. In particular, it was shown that annealing treatments of as quenched samples resulted in a dramatic reduction in the width of the diffraction peaks associated with the elimination of as quenched defects, present in other quasicrystals. Positron annihilation lifetime measurements have a high sensitivity to intrinsic defects and positron annihilation radiation angular correlation measurements are well suited to measurements of electronic structure in systems where the defect effects do not dominate. We have measured positron annihilation lifetime and angular correlations on quasicrystalline samples of Al63Cu25Fe12 in the pure icosahedral phase. DOE

N92-21147# Los Alamos National Lab., NM.
LOW TEMPERATURE OMCVD OF THIN RHODIUM FILMS
J. R. Laia, A. P. Sattelberger, D. C. Smith, and J. C. DeSantis

1992 12 p Presented at the EPD Congress, San Diego, CA, Mar. 1992
(Contract W-7405-eng-36)
(DE92-003861; LA-UR-91-3537; CONF-920353-1) Avail: NTIS HC/MF A03

Thin, highly reflective rhodium films with metal compositions greater than 98 pct. (elemental weight percentage) have been deposited by chemical vapor deposition using Rh(allyl)3 (allyl = eta sup 3-C3H5) in the presence of a hydrogen plasma. Uniform, crystalline films that adhere well to several types of substrates result from depositions at temperatures as low as 150 C. Depositions using H2 (no plasma), or an argon plasma yields material that is amorphous, contains a significant amount (greater than 14 pct.) of residual carbon, and has a dramatically slower growth rate. The composition of these materials does not vary significantly from that of the materials obtained from the in vacuo thermal deposition with Rh(allyl)3. DOE

N92-21152# Argonne National Lab., IL.
THE FINITE SIZE EFFECT ON THE METAL-INSULATOR TRANSITION OF MOCVD GROWN VO2 FILMS
Hyung Kook Kim, R. P. Chiarello, Hoydoo You, M. H. L. Chang, T. J. Zhang, and D. J. Lam Nov. 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-006969; ANL/CP-73695; CONF-911202-44) Avail: NTIS HC/MF A01

We studied the finite size effect on the metal-insulator phase transition and the accompanying tetragonal to monoclinic structural phase transition of VO2 films grown by MOCVD. X ray diffraction measurements and electrical conductivity measurements were done as a function of temperature for VO2 films with out-of-plane particle size ranging from 60 to 310 A. Each VO2 film was grown on a thin TiO2 buffer layer, which in turn was grown by MOCVD on a polished sapphire (112) substrate. The transition was found to be first order. As the out-of-plane particle size becomes larger, the transition temperature shifts and the transition width narrows. For the 60 A film, the transition was observed at approx. 61 C with a transition width of approx. 10 C, while for the 310 A film the transition temperature was approx. 59 C and the transition width approx. 2 C. We also observed thermal hysteresis for each film, which became smaller with increasing particle size. DOE

N92-21155# Argonne National Lab., IL.
CHARACTERIZATION OF HOT ISOSTATICALLY PRESSED Bi-Sr-Ca-Cu-O AS A FUNCTION OF CONSOLIDATION VARIABLES
K. C. Goretta, D. J. Miller, R. B. Poeppel, and A. S. Nash (Marquette Univ., Milwaukee, WI.) Nov. 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-006980; ANL/CP-73717; CONF-911202-47) Avail: NTIS HC/MF A02

Fully dense, bulk Bi2Sr(1.7)CaCu2O(x) (2212) superconductor pellets were made by hot isostatic pressing in an inert atmosphere. Electron microscopy revealed that rotation and bending of the platelike 2212 grains were responsible for much of the densification. Under processing conditions of 825 C and 105 MPa, dense pellets were obtained in 15 min. Many dislocations, planar faults, and, perhaps, intergrowths of the Bi2Sr2CuO(x) phase were produced during pressing. The dislocations were largely present in subgrain boundaries when the pressing times were increased to 45 to 120 min. DOE

N92-21190# Argonne National Lab., IL.
MOMENTUM DENSITY AND 2D-ACAR EXPERIMENTS IN YBa2Cu3O7
A. Bansil (Northeastern Univ., Boston, MA.) and L. C. Smedskjaer Dec. 1991 10 p Presented at the 9th International Conference on Positron Annihilation, Szombathely (Hungary), 26-31 Aug. 1991
(Contract W-31-109-eng-38)
(DE92-007382; ANL/CP-75105; CONF-9108150-6) Avail: NTIS HC/MF A02

We compare measured c-projected 2D-ACAR spectrum from an untwinned single crystal of YBa2Cu3O(sub 7-x) with the corresponding band theory predictions. Many different one-dimensional sections through the spectrum are considered, together with the characteristic amplitudes and shapes of the spectral anisotropies, with a focus on identifying and delineating Fermi surface signatures in the spectra. The positron data clearly show several distinct features of the ridge Fermi surface predicted by the band theory, and give an indication of the pillbox Fermi sheet. The good agreement between theory and experiment suggests that the band theory framework based on the local density approximation (LDA) is capable of providing a substantially correct description of the momentum density and Fermiology of the normal ground state electronic structure of YBa2Cu3O7. DOE

N92-21191# Argonne National Lab., IL.
A TWO-DIMENSIONAL ACAR STUDY OF UNTWINNED YBa2Cu3O(7-x)
L. C. Smedskjaer and A. Bansil (Northwestern Univ., Evanston, IL.) Dec. 1991 9 p Presented at the 9th International Conference on Positron Annihilation, Szombathely (Hungary), 26-31 Aug. 1991
(Contract W-31-109-eng-38)
(DE92-007383; ANL/CP-75104; CONF-9108150-5) Avail: NTIS HC/MF A02

We have carried out 2D-ACAR measurements on an untwinned single crystal of YBa2Cu3O(sub 7-x) as a function of temperature, for five temperatures ranging from 30K to 300K. We show that these temperature-dependent 2D-ACAR spectra can be described to a good approximation as a superposition of two temperature independent spectra with temperature-dependent weighting factors. We show further how the data can be used to correct for the 'background' in the experimental spectrum. Such a 'background corrected' spectrum is in remarkable accord with the corresponding band theory predictions, and displays, in particular, clear signatures of the electron ridge Fermi surface. DOE

N92-21198# Brookhaven National Lab., Upton, NY.
IN SITU X RAY SCATTERING STUDIES OF THE Au(111)/ELECTROLYTE INTERFACE
Jia Wang, B. M. Ocko, A. J. Davenport, and H. S. Isaacs 1991 15 p Presented at the 180th Meeting of the Electrochemical Society, Phoenix, AZ, 13-18 Oct. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007179; BNL-47033; CONF-911047-12) Avail: NTIS HC/MF A03

The adsorption of anions at the Au(111) electrode and the subsequent effect on the gold surface structure have been investigated using x-ray specular reflectivity and grazing incident angle diffraction techniques. The top layer of gold atoms undergoes a reversible phase transition between the 1 x 1 bulk termination and a 23 x radical bar 3 reconstructed phase on changing the potential. The shifts of the phase transition potential in NaCl and NaBr solutions from the one in NaF can be understood by the anion adsorption induced charge effect. The reconstruction formation rate increases in chloride and bromide solutions due to an increase in the surface mobility with anion adsorption. Adsorbed chloride and bromide monolayers can be monitored during a potential scan by the specular reflectivity. DOE

N92-21202# Brookhaven National Lab., Upton, NY.
PHOTODESORPTION FROM COPPER, BERYLLIUM, AND THIN FILMS
C. L. Foerster, H. J. Halama, and G. Korn 1991 21 p Presented at the 38th National Symposium of the American Vacuum Society, Seattle, WA, 11-15 Nov. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007171; BNL-46994; CONF-911132-18) Avail: NTIS HC/MF A03

Ever increasing circulating currents in electron-positron colliders and light sources demand lower and lower photodesportion (PSD)

from the surfaces of their vacuum chambers and their photon absorbers. This is particularly important in compact electron storage rings and B meson factories where photon power of several kw cm(exp -1) is deposited on the surfaces. Given the above factors, we have measured PSD from 1 m long bars of solid copper and solid beryllium, and TiN, Au and C thin films deposited on solid copper bars. Each sample was exposed to about 10(exp 23) photons/m with a critical energy of 500 eV at the VUV ring of the NSLS. PSD was recorded for two conditions: after a 200 C bake-out and after an Ar glow discharge cleaning. In addition, we also measured reflected photons, photoelectrons and desorption as functions of normal, 75 mrad, 100 mrad, and 125 mrad incident photons. DOE

N92-21205# Sandia National Labs., Albuquerque, NM.
TRIMETHYLAMINE ALANE FOR LOW-PRESSURE MOVPE GROWTH OF AlGaAs-BASED MATERIALS AND DEVICE STRUCTURES
R. P. Schneider, R. P. Bryan, E. D. Jones, R. M. Biefield, and G. R. Olbright 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC04-76DP-00789)
(DE92-007658; SAND-91-1563C; CONF-911202-54) Avail: NTIS HC/MF A01

The use of trimethylamine alane (TMAA1) as an alternative to trimethylaluminum (TMA1) for low-pressure metalorganic vapor-phase epitaxy (MOVPE) of AlGaAs thin films as well as complex optoelectronic device structures has been studied in detail. AlGaAs layers were grown in a horizontal reaction chamber at 20 - 110 mbar with growth temperatures in the range 650 C less than or equal to T(sub G) less than or equal to 750 C. Wafer thickness uniformity is strongly dependent on growth pressure, and is acceptable only for the highest linear flow velocities. The 12 K photoluminescence (PL) spectra of AlGaAs layers grown using TMAA1 and TEGa exhibit uniformly intense and narrow bound-exciton emission throughout the growth temperature range investigated. To assess the viability of this new source for the low-pressure OMVPE growth of advanced optoelectronic devices, several optically-pumped vertical-cavity surface-emitting laser (VCSEL) structures were grown using TMAA1 extensively. Room temperature lasing at 850 nm was reproducibly obtained from the VCSEL structures, with a threshold pumping power comparable to similar structures grown by molecular beam epitaxy in our laboratories. DOE

N92-21219# Oak Ridge National Lab., TN.
MICROSCOPIC AND MACROSCOPIC EFFECTS OF ION BOMBARDMENT IN SIMPLE REFRACTORY OXIDES
Alain Perez (Lyon-1 Univ., Villeurbanne, France) and Carl J. McHargue 1991 20 p Presented at the Summer School on Radiation Effects in Solids, Giens (France), 15 Sep. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006858; CONF-9109339-1) Avail: NTIS HC/MF A03

Ion implantation is an attractive technique for altering the near-surface properties of a wide range of materials since it is independent of many of the constraints associated with normal processing methods. Any element can be introduced into a solid in a controlled and reproducible manner by ion implantation. Additionally, ion implantation is a doping process that is non-equilibrium in nature, a feature that often leads to the formation of compositions and structures that cannot be achieved by conventional processing methods. Despite the past successes achieved by applying ion beam processing to semiconductors and metallic systems, traditionally there have been substantially fewer investigations of ion beam processing as applied to insulating materials. Recently, however this situation has changed, and there is a resurgence of interest in the use of ion beam processing to after the physical, chemical, electrical, optical and mechanical properties of insulators. In the present article some of the more recent work dealing with ion implantation of simple refractory oxides will be reviewed. The implantation and annealing behavior of crystalline MgO, Al2O3 and TiO2 have been studied in considerable detail, and we will highlight the investigations carried out on these materials. The remainder of this paper is organized as follows. Section 2 terminates with a brief description of some of the experimental procedures that are typically employed. Section 3 and 4 will discuss, in general terms, the feature of damage production during ion implantation of oxides. Section 5 will be concerned specifically with the chemical effects induced in the implanted layer. Finally, section 6 will treat the effects of thermal annealings on defects and precipitated phases and section 7 the property-modifications. A short summary and conclusion are included in section 8. DOE

N92-21294# Howard Univ., Washington, DC.
LASER ASSISTED CVD GROWTH OF AlN AND GaN Technical Report, 1 Aug. 1990 - 31 Jul. 1991
Joshua B. Halpern, Joan M. Frye, Gary Harris, and M. Aluko 10 Oct. 1991 35 p
(Contract F49620-89-C-0108)
(AD-A244464; AFOSR-91-1010TR) Avail: NTIS HC/MF A03 CSCL 09/3

This is the second annual report of a project for investigating the laser induced CVD growth of AlN and GaN. In the second year, significant progress has been made in the growth of AlN. AlN films have been produced by laser ablation. A new LI CVD source for Al atoms has been characterized and verified by growth of Al films. Additionally, some progress has been made in the understanding and characterization of alkyl aluminum-amino adducts which may be used for the growth of AlN. The goal of this project is to design, test, and verify advanced laser induced chemical vapor deposition processes (LI-CVD), specifically for the growth of AlN. In the past year, we have made progress in three areas: (1) Rapid growth of AlN thin films by laser ablation of AlN powders. (2) Demonstration of an advanced LI-CVD method for deposition of Al from trimethylaluminum (TMAl). This method was designed to be used as the aluminum atom source in AlN growth, but also has utility for laser deposition of aluminum interconnects, an area of current interest. (3) Synthesis and characterization of a number of stable alkyl aluminum-nitrogen containing adducts for future use in film growth. We have grown alkylaluminum nitrogen thin films by laser ablation of powdered alkylaluminum nitrogen compressed into a pellet. GRA

N92-21431# Rome Lab., Griffiss AFB, NY.
ROOM TEMPERATURE CARRIER LIFETIMES AND OPTICAL NONLINEARITIES OF GaInAs / AlInAs AND GaAlInAs / AlInAs MQW DEVICES AT 1.3 MICROMETERS Report, Jun. 1990 - Jun. 1991
Steven T. Johns, Mark F. Krol, John L. Stacy, and Raymond K. Boncek Oct. 1991 47 p
(AF Proj. 4600)
(AD-A242837; RL-TR-91-316) Avail: NTIS HC/MF A03 CSCL 20/3

The room temperature nonlinear absorption spectra of a GaInAs/AlInAs and a GaAlInAs/AlInAs multiple quantum well (MQW) were measured near 1.3 microns using a pump probe technique. Saturation carrier densities at the heavy-hole exciton peak were determined to be 1.2 x 10 to the 18th power and 1.0 x 10 to the 18th power/cc with carrier lifetimes of approx. 2.3 ns and approx. 750 ps for the two samples, respectively. Fabry-Perot etalons with integrated mirrors grown by molecular beam epitaxy (MBE) with GaInAs/AlInAs MQWs as spacer layers were also fabricated as optical switching devices. A 175 ps recovery time was measured for the etalon at room temperature. GRA

N92-21455*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Science.
GROWTH AND CHARACTERIZATION OF HIGH-PERFORMANCE PHOTOREFRACTIVE BaTiO3 CRYSTALS Final Technical Report
C. Warde, M. H. Garrett, J. Y. Chang, H. P. Jenssen, and H. L. Tuller Dec. 1991 94 p
(Grant NAG1-996)
(NASA-CR-190193; NAS 1.26:190193) Avail: NTIS HC/MF A05 CSCL 20L

Barium titanate has been used for many nonlinear optical applications primarily because it has high grain and high self-pumped phase conjugate reflectivities. However, barium titanate has had a relatively slow response time, and thus low sensitivity. Therefore, it has not been suited to real-time operations. In this report we will describe the modifications in crystal growth, doping, reduction, and poling that have produced barium titanate crystals with the fastest photorefractive response time reported to date, approximately 21 microseconds with a beam-coupling gain coefficient of 38.7 cm(exp -1) and the highest sensitivity reported to date of 3.44 cm(exp 3)/kJ. The sensitivity of these barium titanate crystals is comparable to or greater than other photorefractive oxides. We will show, for the first time, beam-coupling in barium titanate at video frame rates. We infer from response time measurements that barium titanate has a phonon limited mobility. Also, photorefractive response time measurements as a function of the crystallographic orientation and grating wave vector for our cobalt-doped oxygen reduced crystals indicate that their faster response time arise because of an increase in the free carrier lifetime. Author

N92-21499* National Aeronautics and Space Administration. Pasadena Office, CA.

DEVICE FOR MECHANICALLY STABILIZING WEB RIBBON BUTTONS DURING GROWTH INITIATION Patent

Paul K. Henry, inventor (to NASA) and Edward P. Fortier, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 3 Mar. 1992 5 p Filed 10 Feb. 1989 Continuation of abandoned US-Patent-Appl-SN-102934, filed 30 Sep. 1987 (NASA-Case-NPO-17074-2-CU; US-Patent-5,092,956; US-Patent-Appl-SN-311376; US-Patent-Appl-SN-102934; US-Patent-Class-156-617.1; US-Patent-Class-156-608; US-Patent-Class-156-620.1; US-Patent-Class-156-620.3; US-Patent-Class-156-620.4; US-Patent-Class-156-DIG.64) Avail: US Patent and Trademark Office CSCL 20L

The invention relates to a stabilization device for stabilizing dendritic web seed buttons during initiation of crystal growth from a float melt zone. The invention includes angular maintenance means for maintaining a constant angular orientation between the axis of a growth initiation seed and the upper surface of a web button during withdrawal of the web button from the melt. In the preferred embodiment, the angular means includes an adjustable elevation tube which surrounds the seed, the weight of which may be selectively supported by the seed button during web button withdrawal.

Official Gazette of the U.S. Patent and Trademark Office

N92-21568# Arizona Univ., Tucson. Dept. of Materials Science and Engineering.

GRAIN BOUNDARY PHASE EQUILIBRIUM IN METALLIC SYSTEMS

P. A. Deymier Apr. 1991 16 p
(Contract DE-FG02-87ER-45285)
(DE92-006626; DOE/ER-45285/4) Avail: NTIS HC/MF A03

Progresses in the structural and chemical characterization of grain boundaries in metals are reported. We have developed a solid state method for fabrication of a variety of important grain boundaries. This method is based on a sequence of heavy deformation of single crystals followed by controlled recrystallization. The structure of complex grain boundaries such as the quasiperiodic 45 deg (100) twist in pure aluminum or the periodic Sigma 5(310) in aluminum-5 pct. Mg alloy has been elucidated. We have found the structural unit (SU) model to be very powerful for the description of quasiperiodic interfaces. The applicability of the SU model to heterophase interfaces is verified for Si-Al interfaces. Further advances have been achieved in the understanding of the driving forces for grain boundary segregation including elastic and electronic effects. Chemical effects on grain boundary core structure are observed in the case of Al-Mg alloys and Sr doped Si. DOE

N92-21734# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Abt. Korrosion und Kristallzucht.

EXPERIMENTAL INVESTIGATIONS IN BRIDGMAN CRYSTAL GROWTH OF Ge/Ga Ph.D. Thesis - Technische Hochschule

Uwe Moeller May 1991 115 p In GERMAN; ENGLISH summary Translation was announced as ESA-TT-1271 (DLR-FB-91-16; ISSN-0939-2963; ETN-92-90733) Avail: NTIS HC/MF A06; DLR, Wissenschaftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 39 DM

The influence of outer and inner effects on the grown crystal was analyzed during Bridgeman Stockbarger crystal growth. It is shown that the shape of the solid liquid interface mainly depends on the thermal boundary conditions of the growth system. The axial and the radial dopant concentration profile allow conclusions on the influence and type of buoyant convection in the melt. The effects of Peltier pulsing on growth velocity and dopant concentration are not negligible, whereas current density, pulse duration and pulse sequence should be minimized. Using mathematical methods, it is possible to characterize time dependent convections and to evaluate convection velocities. ESA

N92-22035* National Aeronautics and Space Administration. Pasadena Office, CA.

GROWTH OF III-V FILMS BY CONTROL OF MBE GROWTH FRONT STOICHIOMETRY Patent

Frank J. Grunthaner, inventor (to NASA), John K. Liu, inventor (to NASA), and Bruce R. Hancock, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 10 Mar. 1992 6 p Filed 28 Feb. 1990 Supersedes N90-27517 (28 - 21, p 3081) (NASA-Case-NPO-17724-1-CU; US-Patent-5,094,974; US-Patent-Appl-SN-488578; US-Patent-Class-437-85; US-Patent-Class-437-105; US-Patent-Class-437-107; US-Patent-Class-437-133; US-Patent-Class-437-936; US-Patent-Class-437-945; US-Patent-Class-148-DIG.22) Avail: US Patent and Trademark Office CSCL 20L

For the growth of strain-layer materials and high quality single and multiple quantum wells, the instantaneous control of growth front stoichiometry is critical. The process of the invention adjusts the offset or phase of molecular beam epitaxy (MBE) control shutters to program the instantaneous arrival or flux rate of In and As4 reactants to grow InAs. The interrupted growth of first In, then As4, is also a key feature.

Official Gazette of the U.S. Patent and Trademark Office

N92-22040* National Aeronautics and Space Administration. Pasadena Office, CA.

METHOD FOR PRODUCING EDGE GEOMETRY SUPERCONDUCTING TUNNEL JUNCTIONS UTILIZING AN NbN/MgO/NbN THIN FILM STRUCTURE Patent

Brian D. Hunt, inventor (to NASA) and Henry G. LeDuc, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 31 Mar. 1992 7 p Filed 18 Jan. 1991 Continuation of abandoned US-Patent-Appl-SN-387928, filed 1 Aug. 1989 (NASA-Case-NPO-17812-2-CU; US-Patent-5,100,694; US-Patent-Appl-SN-642765; US-Patent-Appl-SN-387928; US-Patent-Class-427-63; US-Patent-Class-427-62; US-Patent-Class-427-419.1; US-Patent-Class-427-419.2; US-Patent-Class-357-5; US-Patent-Class-156-643) Avail: US Patent and Trademark Office CSCL 20L

A method for fabricating an edge geometry superconducting tunnel junction device is discussed. The device is comprised of two niobium nitride superconducting electrodes and a magnesium oxide tunnel barrier sandwiched between the two electrodes. The NbN electrodes are preferably sputter-deposited, with the first NbN electrode deposited on an insulating substrate maintained at about 250 C to 500 C for improved quality of the electrode.

Official Gazette of the U.S. Patent and Trademark Office

N92-22041* National Aeronautics and Space Administration. Pasadena Office, CA.
EDGE GEOMETRY SUPERCONDUCTING TUNNEL JUNCTIONS UTILIZING AN NbN/MgO/NbN THIN FILM STRUCTURE Patent
Brian D. Hunt, inventor (to NASA) and Henry G. LeDuc, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 24 Mar. 1992 7 p Filed 16 Jan. 1991 Continuation of abandoned US-Patent-Appl-SN-387928, filed 1 Aug. 1989 (NASA-Case-NPO-17812-3-CU; US-Patent-5,099,294; US-Patent-Appl-SN-641798; US-Patent-Appl-SN-387928; US-Patent-Class-357-5; US-Patent-Class-357-4; US-Patent-Class-505-862; US-Patent-Class-505-871; Int-Patent-Class-H01L-39/22; Int-Patent-Class-H01L-27/12)
Avail: US Patent and Trademark Office CSCL 20L

An edge defined geometry is used to produce very small area tunnel junctions in a structure with niobium nitride superconducting electrodes and a magnesium oxide tunnel barrier. The incorporation of an MgO tunnel barrier with two NbN electrodes results in improved current-voltage characteristics, and may lead to better junction noise characteristics. The NbN electrodes are preferably sputter-deposited, with the first NbN electrode deposited on an insulating substrate maintained at about 250 C to 500 C for improved quality of the electrode.
Official Gazette of the U.S. Patent and Trademark Office

N92-21606*# National Tsing Hua Univ., Hsinchu (Taiwan). Dept. of Physics and Materials Center.
OXYGEN STABILIZATION INDUCED ENHANCEMENT IN SUPERCONDUCTING CHARACTERISTICS OF HIGH-Tc OXIDES
M. K. Wu, J. T. Chen, and C. Y. Huang (Lockheed Missiles and Space Co., Palo Alto, CA.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 3-17 Prepared in cooperation with Columbia Univ., New York, NY (For primary document see N92-21605 12-24)
(Grant NSC79-0208-M007-95)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21607*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
MICROSTRUCTURE AND MAGNETIZATION OF Y-Ba-Cu-O PREPARED BY MELT QUENCHING, PARTIAL MELTING AND DOPING
Hamid Hojaji, Shouxiang Hu, Karen A. Michael, Aaron Barkatt, Arthur N. Thorpe (Howard Univ., Washington, DC.), and Sidney Alterescu *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 19-26 (For primary document see N92-21605 12-24)
(Grant NAG5-1017)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21608*# Texas Univ., El Paso. Dept. of Metallurgical and Materials Engineering.
EFFECT OF SHOCK PRESSURE ON THE STRUCTURE AND SUPERCONDUCTING PROPERTIES OF Y-Ba-Cu-O IN EXPLOSIVELY FABRICATED BULK METAL-MATRIX COMPOSITES
L. E. Murr, C. S. Niou, and M. Pradhan-Advani *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 27-36 (For primary document see N92-21605 12-24)
(Contracts NAS5-30504; N00014-88-C-0684)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21609*# Clemson Univ., SC. Dept. of Ceramic Engineering.
PRODUCTION OF SUPERCONDUCTOR/CARBON BICOMPONENT FIBERS
S. A. Wise, C. C. Fain, and H. D. Leigh *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 37-42 Sponsored in part by NSF (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21610*# Research Inst. of Industrial Science and Technology, Pohang (Republic of Korea). Physics Div.
THERMAL AND ELECTRIC PROPERTIES OF Nd(1.85)Ce(0.15)CuO(4-y) AND Pr(1.85)Ce(0.15)CuO(4-y) Abstract Only
Z. S. Lim, K. H. Han, Sung-Ik Lee, Yoon H. Jeong, Y. S. Song, and Y. W. Park (Seoul National Univ., Republic of Korea) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 43 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21611*# Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Instituto de Ciencia de Materiales.
TERNARY AND QUATERNARY OXIDES OF Bi, Sr AND Cu
M. T. Casais, P. Millan, I. Rasines, and J. A. Campa (Universidad Complutense, Madrid, Spain) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 45-54 Sponsored in part by Fundacion Domingo Martinez (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21612*# West Virginia Univ., Morgantown. Dept. of Physics.
DEPENDENCE OF TRANSITION TEMPERATURE ON HOLE CONCENTRATION PER CuO2 SHEET IN THE Bi-BASED SUPERCONDUCTORS
J. Zhao and M. S. Seehra *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 55-59 Sponsored in part by DOE (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21613*# Commissariat a l'Energie Atomique, Saclay (France).
SPIN GLASS FREEZING AND SUPERCONDUCTIVITY IN YBa2(Cu(1-x)Fe(x))3O7 ALLOYS
I. Mirebeau, M. Hennion, J. Dianoux, V. Caignaert, T. E. Phillips, and K. Moorjani (Johns Hopkins Univ., Laurel, MD.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 61-68 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21614*# General Electric Co., Princeton, NJ. Astrospace Div.
THERMAL RESPONSE OF LARGE AREA HIGH TEMPERATURE SUPERCONDUCTING YBaCuO INFRARED BOLOMETERS
Ali E. Khalil *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 69-82 Submitted for publication (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21615*# West Virginia Univ., Morgantown. Dept. of Chemistry.
MICROWAVE (EPR) MEASUREMENTS OF THE PENETRATION DEPTH MEASUREMENTS OF HIGH-Tc SUPERCONDUCTORS
N. S. Dalal, B. Rakvin, T. A. Mahl, A. S. Bhalla, and Z. Z. Sheng *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 83-88 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21616*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
INHOMOGENEITIES IN SINGLE CRYSTALS OF CUPRATE OXIDE SUPERCONDUCTORS
K. Moorjani, J. Bohandy, B. F. Kim, and F. J. Adrian *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 89-95 (For primary document see N92-21605 12-24)
(Contract N00039-89-C-5031)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21617*# Naval Research Lab., Washington, DC.
THE COLOR OF POLARIZATION IN CUPRATE SUPERCONDUCTORS
H. A. Hoff, M. S. Osofsky, W. L. Lechter (Sachs/Freeman Associates, Inc., Landover, MD.), and C. S. Pande *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 97-106 Sponsored in part by Navy, DARPA, and Nuclear Defence Agency (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21618*# Ohio State Univ., Columbus. Dept. of Materials Science and Engineering.
EFFECT OF DOPING IN THE Bi-Sr-Ca-Cu-O SUPERCONDUCTOR
S. A. Akbar, M. S. Wong, M. J. Botelho, Y. M. Sung, M. Alauddin, C. E. Drummer, and M. J. Fair (Wagner Coll., Staten Island, NY.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 107-112 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21619*# Central Electronics Engineering Research Inst., Pilani (India). Semiconductor Devices Area.
STABILIZATION OF HIGH Tc PHASE IN BISMUTH CUPRATE SUPERCONDUCTOR BY LEAD DOPING Abstract Only
Ram. P. Gupta, J. P. Pachauri, W. S. Khokle, K. C. Nagpal, and S. K. Date (National Chemical Lab. of India, Poona.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 113-114 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21620*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
STRUCTURE AND SUPERCONDUCTING PROPERTIES OF ((Ln(1-x)Ln*(x) 1/2 (Ba(1-y)Sr(y) 1/3 Ce 1/6)8Cu6O(z) Abstract Only
H. Yamauchi, T. Wada, A. Ichinose, Y. Taegashi, T. Kaneko, S. Ikegawa, and S. Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 115 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21621*# Oslo Univ. (Norway). Dept of Chemistry.
COMPATIBILITIES OF YBa2Cu3O(9-DELTA) TYPE PHASE IN QUINTENARY SYSTEMS Y-Ba-Cu-O-X (IMPURITY)
P. Karen, O. Braaten, H. Fjellvag, and A. Kjekshus *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 117-126 Sponsored in part by Norwegian Council for Science and Humanities (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21622*# National Inst. of Standards and Technology, Gaithersburg, MD. Ceramics Div.
PROCESSING Bi-Pb-Sr-Ca-Cu-O SUPERCONDUCTORS FROM AMORPHOUS STATE
C. K. Chiang, W. Wong-Ng, L. P. Cook, S. W. Freiman, N. M. Hwang, M. Vaudin, M. D. Hill, R. D. Shull, A. J. Shapiro, and L. J. Swartzendruber et al *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 127-136 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21623*# Academy of Sciences of the Moldavian SSR, Kishinev. Inst. of Applied Physics.
COMPOSITE SUPERCONDUCTING WIRES OBTAINED BY HIGH-RATE TINNING IN MOLTEN Bi-Pb-Sr-Ca-Cu-O SYSTEM
A. D. Grosav, L. A. Konopko, and N. I. Leporda *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 137-144 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21624*# University of South Florida, Tampa. Noise and Reliability Research Lab.
LOW FREQUENCY ELECTRICAL NOISE ACROSS CONTACTS BETWEEN A NORMAL CONDUCTOR AND SUPERCONDUCTING BULK YBa2Cu3O7
J. Hall and T. M. Chen *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 145-148 (For primary document see N92-21605 12-24)
(Contract MDA972-88-J-1006)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21625*# Saurashtra Univ., Rajkot (India). Dept. of Physics.
SUPERCONDUCTIVITY IN 2-2-3 SYSTEM Y2Ba2Cu2O(8+DELTA)
H. H. Joshi, G. J. Baldha, R. B. Jotania, S. M. Joshi, H. Mohan, P. B. Pandya, H. N. Pandya, and R. G. Kulkarni *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 149-153 Sponsored in part by University Grants Commission, New Delhi, India (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21626*# Karachi Univ. (Pakistan). Solid State Research Lab.
STUDY OF THE SUPERCONDUCTING PROPERTIES OF THE Bi-Ca-Sr-Cu-O SYSTEM
Musheer H. Khan, S. M. M. R. Naqvi, and S. M. Zia-ul-Haq *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 155-158 Sponsored in part by National Scientific Research and Development Board, and Karachi Univ. (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21627*# Sofia Univ. (Bulgaria). Faculty of Physics.
NOVEL SUPERCONDUCTING PHASES OF TI-BASED COMPOUNDS
I. Z. Kostadinov, M. Mateev, M. Michov, V. Skumriev, and E. Tsakin *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 159-164 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21628*# Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Dept. of Electroceramics.
SYNTHESIS OF Y1BaCu3O(x) SUPERCONDUCTING POWDERS BY INTERMEDIATE PHASE REACTIONS

C. Moure, J. F. Fernandez, J. Tartaj, P. Recio, and P. Duran *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 165-172 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21629*# New York State Coll. of Ceramics, Alfred.
GRAIN ORIENTATION IN HIGH Tc SUPERCONDUCTORS BY MOLTEN SALT POWDER SYNTHESIS
Sudhakar Gopalakrishnan and Walter A. Schulze *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 173-180 Sponsored in part by New York State Institute of Superconductivity (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21630*# National Inst. of Standards and Technology, Gaithersburg, MD. Material Science and Engineering Lab.
LEVITATION OF SUPERCONDUCTING COMPOSITES
C. K. Chiang, M. Turchinskaya, L. J. Swartzendruber, R. D. Shull, and L. H. Bennett *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 181-185 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21631*# Barcelona Univ. (Spain). Dept. of Physics.
FLUX CREEP IN Bi2Sr2Ca1Cu2O(8+x) SINGLE CRYSTALS
E. Agostinelli, D. Fiorani, A. M. Testa, and J. Tejada *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 189-197 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21632*# University of South Florida, Tampa. Dept. of Electrical Engineering.
ELLIPTICAL FLUX VORTICES IN YBa2Cu3O7
H. Hickman, A. J. Dekker, and T. M. Chen *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 199-201 (For primary document see N92-21605 12-24)
(Contract MDA972-88-J-1006)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21633*# Maryland Univ., College Park. Dept. of Chemical and Nuclear Engineering.
VORTEX MOVEMENT AND MAGNETIZATION OF HIGH Tc SUPERCONDUCTORS
A. L. Roytburd and M. J. Turchinskaya (National Inst. of Standards and Technology, Gaithersburg, MD.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 203-212 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21634*# National Inst. of Standards and Technology, Gaithersburg, MD. Materials Science and Engineering Lab.
FLUX FLOW AND FLUX DYNAMICS IN HIGH-Tc SUPERCONDUCTORS
L. H. Bennett, M. Turchinskaya, L. J. Swartzendruber, A. Roitburd, D. Lundy, J. Ritter, and D. L. Kaiser *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 213-229 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21635*# Max-Planck-Inst. fuer Festkoerperforschung, Stuttgart (Germany, F.R.).
RIGID LEVITATION, FLUX PINNING, THERMAL DEPINNING AND FLUCTUATION IN HIGH-Tc SUPERCONDUCTORS
E. H. Brandt *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 230-239 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21636*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
COMPARATIVE STUDY OF FLUX PINNING, CREEP AND CRITICAL CURRENTS BETWEEN YBaCuO CRYSTALS WITH AND WITHOUT Y2BaCuO5 INCLUSIONS
Masato Murakami, Satoshi Gotoh, Hiroyuki Fujimoto, Naoki Koshizuka, and Shoji Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 241-248 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21637*# National Inst. of Standards and Technology, Gaithersburg, MD. Materials Science and Engineering Lab.
LOWER CRITICAL FIELD MEASUREMENTS IN YBa2Cu3O(6+x) SINGLE CRYSTALS
D. L. Kaiser, L. J. Swartzendruber, F. W. Gayle, and L. H. Bennett *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 249-255 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21638*# Tokyo Univ. (Japan). Dept. of Industrial Chemistry.
OXIDE SUPERCONDUCTORS UNDER MAGNETIC FIELD Abstract Only
K. Kitazawa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 257 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21639*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MICROWAVE CONDUCTIVITY OF LASER ABLATED YBa2Cu3O(7-DELTA) SUPERCONDUCTING FILMS AND ITS RELATION TO MICROSTRIP TRANSMISSION LINE PERFORMANCE
K. B. Bhasin, J. D. Warner, C. M. Chorey, B. T. Ebihara, R. R. Romanofsky, V. O. Heinen, F. A. Miranda, and W. L. Gordon (Case Western Reserve Univ., Cleveland, OH.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 261-269 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21640*# Oak Ridge National Lab., TN. Chemical Physics Section.
LASER SURFACE INTERACTION OF HIGH-Tc SUPERCONDUCTORS
C. H. Chen, M. P. McCann, and R. C. Phillips *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 271-278 (For primary document see N92-21605 12-24)
(Contract DE-AC05-84OR-21400)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21641*# Bell Communications Research, Inc., Red Bank, NJ.
PERSPECTIVES ON HIGH TEMPERATURE SUPERCONDUCTING ELECTRONICS Abstract Only

T. Venkatesan *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 279 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21642*# Matsushita Electric Industrial Co. Ltd., Osaka (Japan). Central Research Labs.
PREPARATION AND CHARACTERISTICS OF SUPERCONDUCTING CUPRATE THIN FILMS: Nd(2-x)Ce(x)CuO4 AND SUBSTRATED Bi-SYSTEM
H. Adachi, S. Hayashi, K. Setsune, S. Kohiki, Y. Ichikawa, and K. Wasa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 281-290 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21643*# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
HIGH-T(c) SQUID APPLICATION IN MEDICINE AND GEOPHYSICS
V. N. Polushkin, S. V. Uchaikin, and B. V. Vasiliev *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 291-295 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21644*# Istituto Nazionale di Fisica Nucleare, Rome (Italy). Dip. di Fisica.
MICROSTRUCTURES AND PROPERTIES OF SUPERCONDUCTING Y-ErBaCuO THIN FILMS OBTAINED FROM DISORDERED Y-ErBaF2Cu FILMS
P. Cikmach, M. Diociaiuti, A. Fontana, C. Giovannella, M. Iannuzzi, C. Lucchini, V. Merlo, R. Messi, L. Paoluzi, and L. Scopa (Consiglio Nazionale delle Ricerche, Rome, Italy) et al *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 297-305 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21645*# Johns Hopkins Univ., Baltimore, MD. Dept. of Electrical and Computer Engineering.
OPTICAL AND MICROWAVE DETECTION USING Bi-Sr-Ca-Cu-O THIN FILMS
B. E. Grabow, R. M. Sova, B. G. Boone, K. Moorjani, B. F. Kim, J. Bohandy, F. Adrian, and W. J. Green *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 307-316 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21646*# Oklahoma Univ., Norman. School of Electrical Engineering and Computer Science.
IN-SITU INTEGRATED PROCESSING AND CHARACTERIZATION OF THIN FILMS OF HIGH TEMPERATURE SUPERCONDUCTORS, DIELECTRICS AND SEMICONDUCTORS BY MOCVD Abstract Only
R. Singh, S. Sinha, N. J. Hsu, R. P. S. Thakur, P. Chou, A. Kumar, and J. Narayan (North Carolina State Univ., Raleigh.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 317 (For primary document see N92-21605 12-24)
(Contract MDA972-88-D-0004)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21647*# Fujitsu Ltd., Atsugi (Japan).
MAGNETIC RELAXATION IN THE 110 K SUPERCONDUCTING PHASE IN Bi-Sr-Ca-Cu-O THIN FILMS
Atsushi Tanaka, Jason Crain, Nobuo Kamehara, and Koichi Niwa *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 319-322 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21648*# Emcore Corp., Somerset, NJ.
IN-SITU DEPOSITION OF YBCO HIGH-Tc SUPERCONDUCTING THIN FILMS BY MOCVD AND PE-MOCVD
J. Zhao, D. W. Noh, C. Chern, Y. Q. Li, P. E. Norris, B. Kear, and B. Gallois (Stevens Inst. of Tech., Hoboken, NJ.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 323-330 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21649*# Drexel Univ., Philadelphia, PA. Dept. of Physics and Atmospheric Science.
AN EXPLANATION FOR THE RISE IN Tc IN THE Tl- AND Bi-BASED HIGH TEMPERATURE SUPERCONDUCTORS Abstract Only
S. M. Bose and P. Longe (Liege Univ., Belgium) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 331 (For primary document see N92-21605 12-24)
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N92-21650*# IBM Research Lab., Yorktown Heights, NY.
CRITICAL CURRENTS AND HIGH-TEMPERATURE SUPERCONDUCTORS Abstract Only
P. Chaudhari *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 333 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21651*# Stanford Univ., CA. Dept. of Physics.
THE SUPERCONDUCTING STATE OF THE HIGH-TRANSITION TEMPERATURE SUPERCONDUCTORS: EXPERIMENTAL BASIS Abstract Only
W. A. Little *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 337 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21652*# Bell Telephone Labs., Inc., Murray Hill, NJ.
PHENOMENOLOGICAL THEORY OF THE NORMAL AND SUPERCONDUCTIVE STATES OF Cu-O AND Bi-O METALS Abstract Only
C. M. Varma *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 339 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21653*# Centre National de la Recherche Scientifique, Grenoble (France).
CHARGE TRANSFER POLARISATION WAVE IN HIGH Tc OXIDES AND SUPERCONDUCTIVE PAIRING
B. K. Chakraverty *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 341-351 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21654*# California Univ., Berkeley. Lawrence Berkeley Lab.
CORRELATION OF NORMAL AND SUPERCONDUCTING PROPERTIES AND UNIFIED APPROACH TO THE DESCRIPTION OF HIGH Tc OXIDES
V. Z. Kresin and S. A. Wolf (Naval Research Lab., Washington,

DC.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 353-364 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21655*# Northwestern Univ., Evanston, IL. Dept. of Physics and Astronomy.
ELECTRONIC STRUCTURE FERMI LIQUID THEORY OF HIGH Tc SUPERCONDUCTORS: COMPARISON OF PREDICTIONS WITH EXPERIMENTS
Jaejun Yu and A. J. Freeman *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 365-371 Sponsored in part by NASA. Ames Research Center (For primary document see N92-21605 12-24)
(Grant NSF DMR-88-21571)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21656*# Johns Hopkins Univ., Baltimore, MD. Dept. of Physics and Astronomy.
INCOHERENT VS. COHERENT BEHAVIOR IN THE NORMAL STATE OF COPPER OXIDE SUPERCONDUCTORS Abstract Only
Zlatko Tesanovic *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 373-374 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21657*# Pennsylvania State Univ., University Park.
THE ELECTRONIC HAMILTONIAN FOR CUPRATES Abstract Only
James F. Annett, A. K. McMahan, and Richard M. Martin (Illinois Univ., Urbana-Champaign.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 375 (For primary document see N92-21605 12-24)
(Contract W-7405-eng-48; NSF DMR-86-12860)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21658*# Silesian Medical Academy, Katowice (Poland). Inst. of Physics.
THE RELATION BETWEEN FERROELASTICITY AND SUPERCONDUCTIVITY Abstract Only
A. Molak and R. Manka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 377-378 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21659*# Army Materials Technology Lab., Watertown, MA. Materials Science Branch.
HIGH Tc SUPERCONDUCTORS: THE SCALING OF Tc WITH THE NUMBER OF BOUND HOLES ASSOCIATED WITH CHARGE TRANSFER NEUTRALIZING THE MULTIVALENCE CATIONS
G. C. Vezzoli, M. F. Chen, and F. Craver *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 379-383 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21660*# Academy of Sciences (USSR), Svierdlovsk. Inst. of Chemistry.
ELECTRON ENERGY SPECTRUM AND MAGNETIC INTERACTIONS IN HIGH-Tc SUPERCONDUCTORS
S. A. Turshevski, A. I. Liechtenstein, V. P. Antropov, and V. A. Gubanov *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 385-387 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21661*# Pedigogical Univ., Czestochowa (Poland).
COUPLED BIPOLARONS AND OPTICAL PHONONS AS A MODEL FOR HIGH-Tc SUPERCONDUCTORS
J. Kasperczyk *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 389-392 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21662*# Polish Academy of Sciences, Warsaw. Inst. of Physics.
XES STUDIES OF DENSITY OF STATES OF HIGH TEMPERATURE SUPERCONDUCTORS Abstract Only
Gabriel Jasiolek *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 393 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21663*# Academy of Sciences (USSR), Moscow. Inst. of Physics.
SUPERCONDUCTIVITY IN THE Sn-Ba-Sr-Y-Cu-O SYSTEM Abstract Only
K. S. Aleksandrov, B. P. Khrustalev, S. N. Krivomazov, M. I. Petrov, A. D. Vasilyev, and S. A. Zwegintsev *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 395-396 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21664*# Connecticut Univ., Storrs. Dept. of Physics.
STUDIES OF LOCAL MAGNETISM AND LOCAL STRUCTURE IN La(2-x)Sr(x)CuO4 Abstract Only
J. I. Budnick, Z. Tan, and M. Filipkowski *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 397-398 Sponsored in part by Dept. of Higher Education, State of Connecticut (For primary document see N92-21605 12-24)
(Contracts DE-AS05-80ER-10742; DE-AC02-76CH-00016)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21665*# Pavia Univ. (Italy). Dipt. di Fisica.
MAGNETIC CORRELATIONS IN La(2-x)Sr(x)CuO4 FROM NQR RELAXATION AND SPECIFIC HEAT
F. Borsa and A. Rigamonti (Iowa State Univ. of Science and Technology, Ames.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 399-411 Sponsored in part by INFN and INFM-GNSM (For primary document see N92-21605 12-24)
(Contract W-7405-eng-82; INFN-MSC-1990-92)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21666*# South Carolina Univ., Columbia. Dept. of Astronomy.
MAGNETISM AND SUPERCONDUCTIVITY OF SOME Tl-Cu OXIDES Abstract Only
Timir Datta *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 413 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21667*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
A TECHNIQUE TO MEASURE THE THERMAL DIFFUSIVITY OF HIGH Tc SUPERCONDUCTORS
Charles E. Powers *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 417-421 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21668*# General Electric Co., Princeton, NJ. Astro-Space Div.
THE EFFECTS OF SPACE RADIATION ON THIN FILMS OF YBa2Cu3O(7-x)
R. Herschitz, A. Bogorad, C. Bowman, S. S. Seehra, A. Mogro-Campero, and L. G. Turner (General Electric Co., Schenectady, NY.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 423-428 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21669*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
AN INSTRUMENT FOR SPATIAL CONDUCTIVITY MEASUREMENTS OF HIGH Tc SUPERCONDUCTING (HTSC) MATERIALS
T. VanSant *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 429-434 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21670*# Fluoramics, Inc., Upper Saddle River, NJ.
PLASTIC SUPERCONDUCTOR BEARINGS ANY SIZE-ANY SHAPE: 77 K AND UP
Franklin G. Reick *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 435-448 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
UPCOMING PLANETARY MISSIONS AND THE APPLICABILITY OF HIGH TEMPERATURE SUPERCONDUCTOR BOLOMETERS
J. Brasunas, V. Kunde, H. Moseley, and B. Lakew (ST Systems Corp., Lanham, MD.) *In its* AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 449-458 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21672*# General Electric Co., Schenectady, NY.
THE EFFECT OF TEMPERATURE CYCLING TYPICAL OF LOW EARTH ORBIT SATELLITES ON THIN FILMS OF YBa2Cu3O(7-x)
A. Mogro-Campero, L. G. Turner, A. Bogorad, and R. Herschitz (General Electric Co., Princeton, NJ.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 459-463 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21674*# United Technologies Research Center, East Hartford, CT.
STATIC AND DYNAMICAL MEISSNER FORCE FIELDS Abstract Only
B. R. Weinberger, L. Lynds, J. R. Hull, and T. M. Mulcahy (Argonne National Lab., IL.) *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 469 (For primary document see N92-21605 12-24)
(Contract W-31-109-eng-38)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21675*# Cornell Univ., Ithaca, NY. Mechanical and Aerospace Engineering.
MAGNETIC FORCES IN HIGH-Tc SUPERCONDUCTING BEARINGS
F. C. Moon *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 471 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21676*# International Superconductivity Technology Center, Tokyo (Japan). Superconductivity Research Lab.
PROGRESS OF RESEARCH OF HIGH-Tc SUPERCONDUCTORS Abstract Only
Shoji Tanaka *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 475 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21677*# National Aeronautics and Space Administration, Washington, DC.
PROSPECTS AND PROGRESS OF HIGH Tc SUPERCONDUCTIVITY FOR SPACE APPLICATIONS
Robert R. Romanofsky and Marty M. Sokoloski *In* NASA. Goddard Space Flight Center, AMSAHTS 1990: Advances in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 477-486 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

N92-21678*# Naval Research Lab., Washington, DC.
US NAVY SUPERCONDUCTIVITY PROGRAM
Donald U. Gubser *In* NASA. Goddard Space Flight Center, AMSARTS '90: Advanced in Materials Science and Applications of High Temperature Superconductors Jan. 1991 p 487-488 (For primary document see N92-21605 12-24)
Avail: NTIS HC/MF A21 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N92-21112# Melbourne Univ., Parkville (Australia). School of Physics.
THE STATUS AND PROSPECTS OF QUANTUM NON-LOCAL FIELD THEORY
N. J. Cornish (Toronto Univ., Ontario) 1991 46 p
(DE92-612014; UM-P-91/88; UTPT-91/15) Avail: NTIS HC/MF A03

A critical review of the physical constraints on the form the non-locality can take is presented. The conclusion of this review is that non-locality must be restricted to interactions with the vacuum sea of virtual particles. A successful formulation of such a theory, Quantum Nonlocal Field Theory (QNFT), is applied to scalar electrodynamics and serves to illustrate how gauge invariance and manifest finiteness can be achieved. The importance of the infinite dimensional symmetry groups that occur in QNFT are discussed as an alternative to supersymmetry. The ability to generate masses by breaking the non-local symmetry with a non-invariant functional measure is given a critical assessment. To demonstrate some of the many novel applications QNFT may make possible, three disparate examples are mooted: the existence of electroweak monopoles, an mechanism for CP violation, and the formulation of a finite perturbative theory of Quantum Gravity. DOE

N92-21127# Melbourne Univ., Parkville (Australia). School of Physics.
INVERSION OF REFLECTION FOR THE ONE-DIMENSIONAL DIRAC EQUATION
G. L. Clerk and A. J. Davies 1991 6 p Submitted for publication
(DE92-612026; UM-P-91/20; OZ-91/6) Avail: NTIS HC/MF A02

It is a general result of one-dimensional non-relativistic quantum mechanics that the coefficient of reflection (reflected flux) is the same irrespective of the direction of traversing a potential barrier, a result that is independent of the barrier shape. In this note, the authors consider the transmission coefficient instead, and derive a strong result, namely that the transmission amplitude is independent of the direction of barrier traversal. That is, the transmission amplitude has the same complex phase as well as being unchanged in magnitude by changing the barrier around. This process was called inversion of reflection. DOE

N92-21492# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
INFORMAL REVIEW OF RENORMALIZATION IN QUANTUM FIELD THEORY
J. N. Islam Sep. 1991 28 p
(PB92-115559; IHES/P/91/62) Avail: NTIS HC/MF A03 CSCL 20C

An introduction to Professor Abdus Salam's 1951 paper, a section reviewing renormalization (the S-matrix regularization dimensional regularization, renormality, the renormalization group, renormalizability), the Bogoliubov-Parasiuk renormalization scheme, equivalence of the Dyson-Salam, Bogoliubov-Parasiuk-Hepp, and Zimmerman schemes, and the renormalization group II are discussed. Author

N92-21553# Sao Paulo Univ. (Brazil). Inst. de Fisica.
ON THE CALCULATION OF FINITE-TEMPERATURE EFFECTS IN FIELD THEORIES
F. T. Brandt, J. Frenkel, and J. C. Taylor (Cambridge Univ., England) Mar. 1991 22 p
(DE92-612015; IFUSP-P-886) Avail: NTIS HC/MF A03

We discuss an alternative method for computing finite temperature effects in field theories, within the framework of the imaginary time formalism. Our approach allows for a systematic calculation of the high temperature expansion in terms of Riemann Zeta functions. The imaginary time result is analytically continued to the complex plane. We are able to obtain the real time limit of the real and the imaginary parts of the Green functions. DOE

N92-21594# International Centre for Theoretical Physics, Trieste (Italy).
SELF-DUAL SPIN-3 AND 4 THEORIES
C. Aragone and A. Khoudeir Aug. 1991 15 p
(DE92-614147; IC-91/204) Avail: NTIS HC/MF A03

We present self-dual pure spin-3 and 4 actions using the physical relevant Dreibein fields. Since these actions start with a Chern-Simons like kinetic term (and therefore cannot be obtained through dimensional reduction) one might wonder whether they need the presence of auxiliary, ghost-killing fields. It turns out that they must contain, also in this three dimensional case, auxiliary fields. Auxiliary scalars do not break self-duality; their free action does not contain kinetic terms. DOE

N92-21767# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Thermal Engineering.
PROBLEM OF THE PRINCIPLE OF MINIMUM ENTROPY PRODUCTION
M. J. Lampinen 1992 12 p
(PB92-136589; Rept-47) Avail: NTIS HC/MF A03 CSCL 20M

The aim of the analysis was to show that the principle of minimum entropy production is not necessarily accurately valid even near the thermodynamic equilibrium state. The authors study a simple heat conduction problem, and by using variational calculus together with Fourier's heat conduction law, they show that the minimum entropy production leads to a contradiction with the energy balance equation. However, when the temperature gradient becomes smaller, the temperature distribution derived from the minimum entropy production principle approaches the correct solution. They briefly discuss other aspects of this principle. Author

N92-21795# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Thermal Engineering.
THERMODYNAMIC ANALYSIS OF ELECTROCHEMICAL SYSTEMS WITH A COMPUTER PROGRAM: BASIC THEORY WITH ILLUSTRATIONS
M. J. Lampinen and J. Vuorisalo 1992 61 p
(PB92-136654) Avail: NTIS HC/MF A04 CSCL 20M

The aim of the research was the investigation of the equilibrium state of electrochemical systems. Half cells, fuel cells, secondary and primary batteries were studied. The authors studied the equilibrium problem, where both the composition of the electrolyte and the potentials of the electrodes are unknown. They derived a solution to this problem, which shows that the capacitance of the electrode-electrolyte interface affects the composition of the electrolyte and the electrode potentials. In this context, they discuss the content of the Nernst equation. They developed a concept called the discharge equation, with the aid of which the total electrochemical cells can be studied systemically at various discharge degrees. On the basis of this theory, the authors developed a computer program that can be used for theoretical and analytical purposes. The basic theory behind the program is described in detail, and some representative numerical examples of the use of the program for different applications are presented. Author

N92-22063*# Massachusetts Inst. of Tech., Cambridge.
ON THE MEASUREMENT OF TIME FOR THE QUANTUM HARMONIC OSCILLATOR
Scott R. Shepard *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 177-179 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22065*# Academy of Sciences (USSR), Moscow. Lebedev Physical Inst.
LIMITATIONS ON SQUEEZING AND FORMATION OF THE SUPERPOSITION OF TWO MACROSCOPICALLY DISTINGUISHABLE STATES AT FUNDAMENTAL FREQUENCY IN THE PROCESS OF SECOND HARMONIC GENERATION
S. P. Nikitin and A. V. Masalov *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 195-197 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22073*# Bell Telephone Labs., Inc., Murray Hill, NJ.
SQUEEZED STATES AND PATH INTEGRALS
Ingrid Daubechies and John R. Klauder (Florida Univ., Gainesville.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 247-259 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22074*# Indiana Univ., Bloomington. Dept. of Physics.
SUPERCOHERENT STATES AND PHYSICAL SYSTEMS
B. W. Fatyga, V. Alan Kostelecky, Michael Martin Nieto, and D. Rodney Truax (Calgary Univ., Alberta) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 261-267 Previously announced as N91-30040 Sponsored in part by National Sciences and Engineering Research Council of Canada (For primary document see N92-22045 12-74)
(Contracts DE-AC02-84ER-40125; W-7405-eng-36)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SQUEEZED STATES, TIME-ENERGY UNCERTAINTY RELATION, AND FEYNMAN'S REST OF THE UNIVERSE
D. Han, Y. S. Kim, and Marilyn E. Noz (New York Univ., New York.) *In its* Workshop on Squeezed States and Uncertainty

Relations Feb. 1992 p 269-282 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22077*# Liege Univ. (Belgium). Physique Theorique et Mathematique.
COHERENT STATES AND PARASUPERSYMMETRIC QUANTUM MECHANICS
Nathalie Debergh *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 297-298 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22078*# Ulm Univ. (Germany, F.R.). Abteilung fuer Theoretische Physik 3.
A GAUSSIAN MEASURE OF QUANTUM PHASE NOISE
Wolfgang P. Schleich and Jonathan P. Dowling (Army Missile Command, Redstone Arsenal, AL.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 299-309 Prepared in cooperation with Max-Planck-Inst. fuer Quantenoptik, Garching, Fed. Republic of Germany (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22079*# Pavia Univ. (Italy). Dipt. di Fisica.
IDEAL PHOTON NUMBER AMPLIFIER AND DUPLICATOR
G. M. DAriano *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 311-326 Sponsored in part by Ministero dell'Universita e della Ricerca Scientifica e Tecnologica (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22080*# California Univ., Santa Barbara. Dept. of Physics.
DECOHERENCE IN QUANTUM MECHANICS AND QUANTUM COSMOLOGY
James B. Hartle *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 327-328 (For primary document see N92-22045 12-74)
(Grant NSF PHY-90-08502)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22081*# Colorado Univ., Boulder.
SQUEEZED STATES IN THE THEORY OF PRIMORDIAL GRAVITATIONAL WAVES
Leonid P. Grishchuk *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 329-338 Prepared in cooperation with Sternberg Astronomical Inst., Moscow, USSR (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22082*# Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Mathematics and Statistics.
SQUEEZED STATES: A GEOMETRIC FRAMEWORK
S. T. Ali, J. A. Brooke, and J.-P. Gazeau (Paris VII Univ., France) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 339-341 Prepared in cooperation with Saskatchewan Univ., Saskatoon Sponsored in part by National Science and Engineering Research Council (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22083*# Vanderbilt Univ., Nashville, TN. Dept. of Physics and Astronomy.
WORMHOLES AND NEGATIVE ENERGY FROM THE GRAVITATIONALLY SQUEEZED VACUUM
David Hochberg *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 343-345 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22084*# Chungbuk National Univ. (Republic of Korea). Dept. of Physics.
EXACT SOLUTION OF A QUANTUM FORCED TIME-DEPENDENT HARMONIC OSCILLATOR
Kyu Hwang Yeon, Thomas F. George, and Chung In Um (Korea Univ., Seoul, Republic of Korea) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 347-363 Previously announced as N91-28812 Sponsored in part by Korea Science and Engineering Foundation; Basic Science Research Inst., Ministry of Education; and Navy (For primary document see N92-22045 12-74)
(Grant NSF CHE-90-16789)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22085*# Alabama A & M Univ., Normal. Dept. of Physics.
NONCLASSICAL DEPTH OF A QUANTUM STATE
Ching Tsung Lee *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 365-367 (For primary document see N92-22045 12-74)
(Contract N00014-89-J-1050)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22086*# European Nuclear Energy Agency, Frascati (Italy). Dip. Sviluppo Tecnologie di Punta.
TOWARDS A WAVE THEORY OF CHARGED BEAM TRANSPORT: A COLLECTION OF THOUGHTS
G. Dattoli, C. Mari, and A. Torre *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 369-375 (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

N92-22087*# Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. for Theoretical Physics.
ENTROPIC UNCERTAINTY RELATION AT FINITE TEMPERATURE
Sumiyoshi Abe and Norikazu Suzuki (Max-Planck-Inst. fuer Kernphysik, Heidelberg, Germany, F.R.) *In* NASA. Goddard Space Flight Center, Workshop on Squeezed States and Uncertainty Relations Feb. 1992 p 377-379 Prepared in cooperation with Nihon Univ., Tokyo, Japan Sponsored in part by Alexander von Humboldt Foundation (For primary document see N92-22045 12-74)
Avail: NTIS HC/MF A17 CSCL 20C

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N92-21403# National Academy of Sciences - National Research Council, Washington, DC.
DOCTORATE RECIPIENTS FROM UNITED STATES UNIVERSITIES Summary Report
Delores H. Thurgood and Joanne M. Weinman 1992 106 p
(Grant NSF SRS-85-17008)
Avail: NTIS HC/MF A06

A summary of the results of the 1889-1990 Survey of Earned Doctorates (SED), compiled from questionnaires distributed to graduates as they complete requirements for their doctoral degrees is presented. The first section shows a trend analysis of the number of doctorate recipients, which is broken down into seven sections; field of doctorate, gender, citizenship status, time-to-degree, status, postdoctoral location and plans, and employment sector in the U.S. labor force. The second section examines financial support of doctoral education through primary source of support and indebtedness. The third section specifically examines U.S. citizen minority doctorates under the same subsets as sections one and two. Finally, the appendixes contain a number of data tables, as well as a sample of the questionnaire used for the survey. H.A.

N92-21507# Kansas State Univ., Salina. Dept. of Aeronautical Studies.
THE AVIATION EDUCATION/RESEARCH ENDEAVORS AT KANSAS STATE UNIVERSITY, COLLEGE OF TECHNOLOGY, SALINA Abstract Only
Ken Barnard *In* Wichita State Univ., Techfest 18 Proceedings Jan. 1992 1 p (For primary document see N92-21501 12-01)
Avail: NTIS HC/MF A03 CSCL 01B

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N92-21580# National Science Foundation, Washington, DC. Science and Engineering Indicators Program.
SELECTED DATA ON FEDERAL R AND D FUNDING BY BUDGET FUNCTION: FISCAL YEARS 1990-92
1991 35 p
(NSF-91-319) Avail: NTIS HC/MF A03

Federal funding is examined of research and development components of agency programs, by Federal budget function categories, as proposed by the Administration for fiscal year 1992. Detailed data are also included on actual Federal funding of R&D in FY 1990 and on estimated funding of R&D in FY 1991.

Author

N92-21852# Rolls-Royce Ltd., Derby (England).
ENGINEERING THE MANUFACTURING PROCESS: HOW TO GO FOR IT
S. M. Lyons 1 Nov. 1990 30 p Presented at the Financial Times Conference, 24 May 1990
(PNR-90834; ETN-92-90790) Copyright Avail: NTIS HC/MF A03

The author's perception of the manufacturing process (product design process and production process) is expressed. It is stated that the starting point for any business must be a high level view which sets long term goals and defines the strategies required to meet them. How these strategies should be implemented, with particular emphasis on the manufacturing process, is discussed. In short, the goal is considered obtainable by the management of change, and the recognition of fear factors; by using communication, involvement and training to ease those fear factors; by having clear management strategies and objectives and by the creation of enthusiasm and trust throughout the organization; and by 'getting there and going for it'. ESA

N92-21304*# Pennsylvania State Univ., University Park. Dept. of Industrial and Systems Engineering.
TOTAL QUALITY MANAGEMENT: ANALYSIS, EVALUATION AND IMPLEMENTATION WITHIN ACRV PROJECT TEAMS Final Report
Laura B. Raiman *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 12 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05A

N92-21305*# Ambassador Coll., Big Sandy, TX. Dept. of Computer Information Systems.
ANALYSIS OF ISSUES FOR PROJECT SCHEDULING BY MULTIPLE, DISPERSED SCHEDULERS (DISTRIBUTED SCHEDULING) AND REQUIREMENTS FOR MANUAL PROTOCOLS AND COMPUTER-BASED SUPPORT Final Report
Stephen F. Richards *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 8 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N92-21109# Indian National Scientific Documentation Centre, New Delhi. Education and Training Div.
ENERGY INFORMATION SYSTEMS: A GENERAL OVERVIEW
B. K. Sen 1991 15 p Presented at the National Workshop on Energy Information, Islamabad, Pakistan, 12-16 May 1991
(DE92-611989; INIS-MF-13023; CONF-9105281) Avail: NTIS HC/MF A03

The unprecedented energy crises that engulfed the world in early 1970s brought about a spurt in energy research all over the world, which in turn caused the rapid growth of literature in the field. In order to achieve effective bibliographical control, proper dissemination of information, and rapid access to the desired document, energy information systems of diverse scope came into being. The paper describes the special features of several information systems like International Nuclear Information Systems, which covers world literature on nuclear science and technology; Energy Information Services which takes cares of energy information transfer among the Commonwealth countries of the Asia and Pacific region; and Information Network on New Energy Sources and Technologies for Asia and the Pacific. This system is being developed to ensure smooth energy information transfer amongst non-commonwealth countries of Asia and the Pacific.

DOE

N92-21163# Naval Postgraduate School, Monterey, CA.
A DICTIONARY OF ACQUISITION AND CONTRACTING TERMS M.S. Thesis
Russell G. Roe Dec. 1991 115 p
(AD-A245190) Avail: NTIS HC/MF A06 CSCL 05/1

This thesis is part of a joint research project between students of the Naval Postgraduate school in Monterey, CA and the Air Force Institute of Technology, Wright-Patterson Air Force Base, Dayton, OH. The purpose of the research is to establish working definitions for commonly used contracting and acquisition terms and phrases. Twenty five terms were selected from a master list compiled by previous researchers. Contracting literature and regulations were researched to identify published definitions. The published definitions were used to develop a synthesized definition for each of the twenty five terms. The synthesized definitions were submitted by contracting professionals for examination. The acceptability of proposed definitions was based upon consensus and the input from respondents was used to develop a refined definition. GRA

N92-21181# National Inst. of Standards and Technology, Gaithersburg, MD. Advanced Systems Div.
MONITORING AND REPORTING TECHNIQUES FOR ERROR RATE AND ERROR DISTRIBUTION IN OPTICAL DISK SYSTEMS Final Report
F. L. Podio Oct. 1991 92 p Workshop held in Colorado Springs, CO, 5 Aug. 1991
(PB92-123124; NIST/SP-500/198) Avail: NTIS HC/MF A05 CSCL 05B

The objectives of the workshop were to identify the state-of-the-art on error rate monitoring and reporting techniques in optical disk systems and to promote discussions on possible future implementations. The workshop presentations included the description of a Computer Systems Lab of the National Institute of Standards and Technology (NIST) program for studying error reporting capabilities of optical disk drives, Federal Government needs on error detection, correction and reporting, and the state-of-the-art on error reporting capabilities in current generation drives. Presentations also included the description of the capabilities of error correction and detection current chips and

discussions on error management strategies. During a discussion panel, the participants identified a preliminary set of user requirements and it was suggested that a Government/industry working group be organized in order to document a consensus position between the Federal Government and industry in error reporting capabilities for future generation drives. Author

N92-21241# Royal Military Coll. of Science, Shrivenham (England).
A STUDY INTO AN INFORMATION SYSTEM ON KNOWLEDGE RETENTION IN G3 CIS HQ BAOR M.S. Thesis
D. G. Hebbes 1990 177 p Sponsored by Ministry of Defence (RMCS-EGW/1312(14)/Hebbes; ETN-92-90839) Avail: NTIS HC/MF A09

The G3 information and management branch is responsible for Information Strategy implementation throughout the German theatre of operations. The CALAIS project is a distributed network architecture which is used to support the operations of the theatre, division, and brigade headquarters in both peace and transition to war. The aim of this study was to investigate the perceived problem of the loss of staff and, consequently expertise, from the organization, with the ultimate goal of providing some form of automated support. The initial difficulty was to ensure that the sponsor's perception of the situation did not override the investigation of other problem areas. The business analysis of the organization is detailed and hybrid techniques used to assist in the knowledge acquisition aspects of the elicitation phase are described. The research findings explore the philosophy of knowledge, and methodologies for extracting and structuring the information acquired, e.g., repertory grid and teachback interviewing, and also the problems encountered when using the techniques. The report ressembles a feasibility study and is intended to be a reference document for the sponsor during the ramaining stages of the systems life cycle. An expert system solution was recommended, with the proviso that any future work be conducted by either an expert from within the project or, if an outside knowledge engineer is used then he should be assisted by an expert from the project staff. ESA

N92-21258*# National Inst. of Standards and Technology, Gaithersburg, MD. Advanced Systems Div.
TEST METHODS FOR OPTICAL DISK MEDIA CHARACTERISTICS (FOR 356 mm RUGGEDIZED MAGNETO-OPTIC MEDIA)
Fernando L. Podio Sep. 1991 79 p Sponsored by NASA. Langley Research Center
(NASA-CR-190124; NAS 1.26:190124; PB92-116409; NIST/SP-500/191) Avail: NTIS HC/MF A05; also available SOD HC $4.50 as 003-003-03103-8 CSCL 05B

Standard test methods for computer storage media characteristics are essential and allow for conformance to media interchange standards. The test methods were developed for 356 mm two-sided laminated glass substrate with a magneto-optic active layer media technology. These test methods may be used for testing other media types, but in each case their applicability must be evaluated. Test methods are included for a series of different media characteristics, including operational, nonoperational, and storage environments; mechanical and physical characteristics; and substrate, recording layer, and preformat characteristics. Tests for environmental qualification and media lifetimes are also included. The best methods include testing conditions, testing procedures, a description of the testing setup, and the required calibration procedures. Author

N92-21259# National Security Industrial Association, Washington, DC.
CALS: MAKING IT HAPPEN. PROCEEDINGS OF CALS EXPO '91 CONFERENCE AND EXPOSITION Annual Progress Report No. 4
1991 689 p Prepared in cooperation with Department of Defense, Washington, DC; and Commerce Dept., Washington, DC
(PB92-107655) Avail: NTIS HC/MF A99 CSCL 05B

CALS Expo '91, hosted at the Civic Plaza, Phoenix, Arizona, was the annual national forum for Computer Aided Acquisitions and Logistics Support (CALS) discussions and demonstrations. The theme, 'CALS: Making It Happen', was exemplified in over 40 technical sessions and 125,000 square feet of industry and government exhibit space. Senior government officials and leaders in the industry presented the latest advances in the CALS initiative as well as live demonstrations of CALS in action on the exhibition floor. A new feature this year was the continuous transfer of CALS standard files over CALS-Net '91, the local area network, throughout the exhibition hall. Author

N92-21347# Naval Postgraduate School, Monterey, CA.
A GRAPHICAL BROWSER INTERFACE FOR THE NAVAL ENVIRONMENTAL OPERATIONAL NOWCASTING SYSTEM M.S. Thesis
Joseph P. Voboril Sep. 1991 113 p
(AD-A245154) Avail: NTIS HC/MF A06 CSCL 12/7

A database management system for the Naval Environmental Operational Nowcasting System has been developed at the Naval Oceanographic and Atmospheric Research Laboratory (NOARL), Monterey, CA. The systems design presents a high level view of diverse environmental data for meteorologists at NOARL. Currently the NEONS DBMS has a function key based data browser written in 4GL. This browser, however, is unpopular and little used because of its user unfriendliness and limited functionality. This thesis presents a design for a graphical user interface for the browser based on ergonomic design principles. The purpose of this design is to increase user friendliness and enhance functionality over the existing user interface. The design also serves as a framework for the design of user interfaces for other information systems with rich data types. The design has been favorably evaluated and is currently being implemented by the NOARL development staff. GRA

N92-21366# Naval Postgraduate School, Monterey, CA.
A DICTIONARY OF ACQUISITION AND CONTRACTING TERMS M.S. Thesis
Jon F. Cotters Dec. 1991 90 p
(AD-A245110) Avail: NTIS HC/MF A05 CSCL 05/2

This thesis is a continuation of research initiated by Lieutenant Commander Daniel F. Ryan, SC, USN to establish a basis for defining words and terms used in the field of contracting. The 20 terms defined in this thesis were selected from a master list of contracting/procurement terms compiled by previous researchers. The methodology used to reach a consensus definition was to: (1) synthesize a definition from current published sources; (2) validate these definitions through an opinion survey of a selected group of contracting professionals; and (3) finalize definitions based on a consensus from all sources. Students at the Naval Postgraduate School, Monterey, CA, and the Air Force Institute of Technology, Wright-Patterson Air Force Base, Dayton OH. are conducting concurrent research on this topic. GRA

N92-21381# JAYCOR, San Diego, CA.
THE SMART DATA MANAGER: A USER-FRIENDLY APPROACH TO DATA STORAGE, RETRIEVAL, AND MANIPULATION Technical Report, 1 Aug. 1990 - 30 Jan. 1991
Dave Sargis, Barbara Trautlein, and Daniel Higgins 1 Jan. 1992 47 p
(Contract DNA001-90-C-0060)
(AD-A244701; J200-91-0019/2655; DNA-TR-91-134) Avail: NTIS HC/MF A03 CSCL 12/5

This report summarizes the development and application of a Smart Data Manager (SDM). The SDM was developed as an aid to the DNA in its technical management and utilization of extensive classified data bases. The primary objective of the work was to establish the feasibility of using microcomputers and commercial software to facilitate storage, retrieval, and manipulation of classified underground test (UGT) data. GRA

N92-21434*# Research Inst. for Computing and Information Systems, Houston, TX.
THE JOHNSON SPACE CENTER MANAGEMENT INFORMATION SYSTEMS (JSCMIS). 1: REQUIREMENTS DEFINITION AND DESIGN SPECIFICATIONS FOR VERSIONS 2.1 AND 2.1.1. 2: DOCUMENTED TEST SCENARIO ENVIRONMENTS. 3: SECURITY DESIGN AND SPECIFICATIONS Interim Report
[1986] 12 p Prepared in cooperation with TNT Consulting, Houston, TX
(Contract NCC9-16; RICIS Proj. IM-09)
(NASA-CR-189943; NAS 1.26:189943) Avail: NTIS HC/MF A03 CSCL 05B

The Johnson Space Center Management Information System (JSCMIS) is an interface to computer data bases at NASA Johnson which allows an authorized user to browse and retrieve information from a variety of sources with minimum effort. This issue gives requirements definition and design specifications for versions 2.1 and 2.1.1, along with documented test scenario environments, and security object design and specifications. Author

N92-21447# Nijmegen Univ. (Netherlands). Dept. of Information Systems.
A CONCEPTUAL FRAMEWORK FOR EVOLVING INFORMATION SYSTEMS
E. D. Falkenberg, J. L. H. Oei, and H. A. Proper 24 May 1991 20 p Sponsored in part by Netherlands Organization for Applied Scientific Research TNO
(TR-91-13; ETN-92-90899) Avail: NTIS HC/MF A03

Evolving information systems, which support the information needs of an evolving organization, are addressed. Such a system is able to change at the same pace as the organization does, such that there is no need to interrupt the activities of the organization. Such a system supports changes of all time and application dependent aspects. A conceptual framework of an approach to evolving information systems is presented. The architecture of such a system is explained, where distinctions between metamodel and application model, and between world, action and behavioral aspects of these models are made. Evolution management of application models are discussed, whereby update is regarded as recording, correction or forgetting, and whereby state transitions are considered on three different levels (the organizational level, the recording level and the correction level). A formal specification of this approach to evolution management is provided. ESA

N92-21490# National Inst. of Standards and Technology, Gaithersburg, MD.
NIST X RAY PHOTOELECTRON SPECTROSCOPY (XPS) DATABASE Final Report
C. D. Wagner Oct. 1991 62 p Prepared in cooperation with Surfex Co., Oakland, CA
(PB92-123157; NIST/TN-1289) Avail: NTIS HC/MF A04; also available SOD HC $4.00 as 003-003-03104-6 CSCL 05B

The technique known as x-ray photoelectron spectroscopy (XPS) involves x-ray irradiation of surface samples under high vacuum. Electrons escaping from the samples are sorted and arranged to form a spectrum. A compilation of data for binding energy and kinetic energy of sample electrons from all elements have been collected. Depending on the nature of the chemical bond, the chemical shift can be as much as 10 eV. Over the past six years the author has indexed articles related to the subject area. The data bank contains a total of 13,200 records from a total of 800 papers. Author

N92-21717# Israel Aircraft Industries Ltd., Lod.
ONLINE SEARCH + LOGIC PROGRAMMING = SUBJECT BIBLIOGRAPHY PROCESSING: AN EXPERT SYSTEMS APPROACH TO BIBLIOGRAPHIC PROCESSING
Yuval Lirov and Victor Lirov Feb. 1990 10 p
(IAITIC-90-1015; ITN-92-85135) Avail: NTIS HC/MF A02

A new method for the creation of subject bibliographies is proposed. The method consists of two phases: first, the raw bibliographical material is downloaded from an online bibliographical database (e.g., DIALOG), and then this material is processed using knowledge-based means. Next, a meta-programming approach is applied. The raw bibliographic material is viewed as a logic program upon which a second-order logic program is developed. The entire system, named REX, was written in PROLOG and used to create automatically a subject bibliography on Applications of Logic Programming in Decision and Control. Author (ISA)

N92-21774# National Inst. of Standards and Technology, Gaithersburg, MD. Electricity Div.
VIDEO PROCESSING WITH THE PRINCETON ENGINE AT NIST Final Report
B. F. Field and C. Fenimore Aug. 1991 54 p
(PB92-108950; NIST/TN-1288) Avail: NTIS HC/MF A04; also available SOD HC $3.25 as 003-003-03091-1 CSCL 05B

The NIST program in digital processing, including a newly created Image Processing Laboratory at NIST that is available to governmental, industrial, and academic researchers working on digital image processing, is described. The centerpiece of the laboratory is a video supercomputer, the Princeton Engine, designed and constructed by the David Sarnoff Research Center. The engine provides real-time video and image-processing capability, accepting a variety of video formats over multiple wideband input channels and outputting real-time video for immediate viewing. Because the Engine is programmable, it is possible to use it to evaluate prototypes of image processing components rapidly and efficiently. The hardware capabilities of the Princeton Engine are described as well as the available supporting video equipment in the Laboratory. Two programming examples are included to demonstrate the unusual programming environment and 'language' used to program the Engine. Appendices list the available predefined library modules, and the processor assembly language instructions. Author

N92-21820# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Computer and Information Science.
USE OF TEMPORAL INFORMATION IN ENGLISH VOWEL CLASSIFICATION: EXPERIMENTS WITH THE TIMIT DATABASE
R. Mann 1991 23 p
(PB92-134352; ISBN-951-22-0675-7; Rept-A14) Avail: NTIS HC/MF A03 CSCL 05B

Classification experiments are described which apply the self-organizing feature map and learning vector quantization to the TIMIT multiple-speaker English language database. The feature map was trained with spectral samples from continuous speech, and frame by frame classification was attempted. The resulting quasi-phoneme sequence was then compared to the original segmented speech data. Because of the large number of phoneme classes, only the vowel classification problem was considered. Next, the phoneme classification accuracy was determined when the single frame classifications were combined in a context independent manner to classify phonemes. Finally, it was demonstrated that improved classification is possible if the temporal order of the frames is taken into account. The conclusion is that in order to capture the dynamic nature of English phonemes, the temporal ordering of the speech frames will have to be taken into account. Two possible ways to do this are suggested. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N92-21851# Rolls-Royce Ltd., Derby (England).
EC FUNDING OF COLLABORATIVE RESEARCH PROJECTS
H. C. Hillier 1 Nov. 1990 20 p
(PNR-90833; ETN-92-90789) Copyright Avail: NTIS HC/MF A03

Some of the benefits and opportunities of participating in EC (European Community) research and technology programs, as well as some of the constraints, are looked into. In order to understand

the motives and the mechanisms associated with EC research funding, the history of research and technology in the EC is briefly reviewed. This leads naturally to the concept of framework programs, the setting of the overall strategy and the consequent determination of priorities. Some examples of the current research and technology programs relating to heat engines are given. The status of the current EC research action in aeronautics is reviewed. ESA

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

N92-22023# Norwegian Defence Research Establishment, Kjeller.
SPACE RESEARCH IN NORWAY Annual Report, 1989
Bo Andersen and Berit Soerensen Apr. 1990 82 p Original contains color illustrations
(NSC-(90)3; ISBN-82-7542-004-0; ETN-92-90810) Avail: NTIS HC/MF A05

Five aspects of the science program are addressed: space physics, astrophysics, life sciences, space related facilities and ground based observational sites. The results of the work of several scientists and technologists, each assigned to a particular field of interest and competence, are given. Publications and reports are included. ESA

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N92-21117# Royal Observatory, Edinburgh (Scotland).
JAMES CLERK MAXWELL TELESCOPE Annual Report, 1990
1991 63 p
(ETN-92-90903) Avail: NTIS HC/MF A04

The James Clerk Maxwell Telescope (JCMT) is a 15 m diameter telescope of high surface accuracy, operating in the millimeter and submillimeter bands, and is situated on Mauna Kea in Hawaii. The JCMT facility is described and a scientific report which includes a variety of scientific results over the years 1989 and 1990 showing the range of astronomical problems tackled with the telescope is presented. Operations, which note the decrease in both the time lost to faults and the time required for engineering and commissioning work, are described. Objectives and progress of the instrumentation program are described. A financial statement is presented. ESA

N92-21408# Royal Observatory, Edinburgh (Scotland).
JAMES CLERK MAXWELL TELESCOPE Annual Report, 1990
1990 63 p Prepared in cooperation with Joint Astronomy Centre, Hilo, HI
Avail: NTIS HC/MF A04

The facilities, scientific results, operations, instrumentation, and financial status of the observatory are discussed in this first annual report. The tripartite agreement between England, the Netherlands, Canada, and the U.S. (University of Hawaii) on operation and access to the submillimeter telescope is included. Observatory time allocations are given for various projects through February 1991. Finally, a list of refereed journal publications generated between 1987 and 1990 is presented. H.A.

N92-21444 Colorado Univ., Boulder.
MULTISPECTRAL OBSERVATIONS OF THE DIFFUSE INTERSTELLAR MEDIUM Ph.D. Thesis
Mary Marsha Allen 1991 155 p
Avail: Univ. Microfilms Order No. DA9206593

This work describes observations of the diffuse interstellar medium in the three wavelength bands; ultraviolet (1000 to 1300 A covered by the Copernicus satellite), far-ultraviolet (500 to 1800 A from the Voyager 1 and 2 spacecraft), and optical (3800 to 4300 A obtained from ground based observations). Chapter two deals with the abundance and depletion of elements in the interstellar medium. Although Copernicus was limited to brighter stars, we obtained abundances and depletions for the lines of sight to sigma S(sub co) and theta C(sub ar). We find that for these and other lines of sight, the element-to-element depletion pattern is remarkably stable. Chapter three discusses extinction along the line of sight to several O and B stars which were observed by Voyager 1 and 2. By observing stars which were generally unreddened and comparing them to reddened stars, the interstellar extinction curve has been extended below 1000 A. The results show that for all the cases we have studied, the selective extinction continues to rise for shorter wavelengths. Chapter four deals with ground-based observations of CH(+). The overabundance of CH(+) in the interstellar medium is a problem in that the radiative reaction rate of C(+) and H is much too slow to give the abundance seen, and also because CH(+) is easily destroyed. An endothermic reaction of C(+) and H2 may create enough CH(+), but it requires shock waves that provide the 0.4 eV of energy needed for the reaction to proceed. In many previous studies, the amount of CH(+) seems to increase as E(B - V) increases, which is not what we would expect if the shock formation model is correct. However, these studies deal primarily with bright stars with E(B - V) less than 0.5. In the work described in this chapter, we have looked at stars with E(B - V) up to +1.13, and have found that the abundance of CH(+) does not appear to increase for more reddened stars. Dissert. Abstr.

N92-21495*# Texas Univ., Austin. Center for Space Research.
GEOPHYSICAL PARAMETERS FROM THE ANALYSIS OF LASER RANGING TO STARLETTE Final Technical Report, 15 Mar. 1986 - 31 Dec. 1991
B. E. Schutz, C. K. Shum, and B. D. Tapley 23 Mar. 1992 8 p (Grant NAG5-757)
(NASA-CR-190119; NAS 1.26:190119) Avail: NTIS HC/MF A02 CSCL 03A

The results of geodynamic research from the analysis of satellite laser ranging data to Starlette are summarized. The time period of the investigation was from 15 Mar. 1986 to 31 Dec. 1991. As a result of the Starlette research, a comprehensive 16-year Starlette data set spanning the time period from 17 Mar. 1975 through 31 Dec. 1990, was produced. This data set represents the longest geophysical time series from any geodetic satellite and is invaluable for research in long-term geodynamics. A low degree and order ocean tide solution determined from Starlette

has good overall agreement with other satellite and oceanographic tide solutions. The observed lunar deceleration is -24.7 +/- 0.6 arcsecond/century(exp 2), which agrees well with other studies. The estimated value of J2 is (-2.5 +/- 0.3) x 10(exp -11) yr(exp -1), assuming there are no variations in higher degree zonals and that the 18.6-year tide is fixed at an equilibrium value. The yearly fluctuations in the values for S(sub a) and S(sub sa) tides determined by the 16-year Starlette data are found to be associated with changes in the Earth's second degree zonal harmonic caused primarily by meteorological excitation. The mean values for the amplitude of S(sub a) and S(sub sa) variations in J2 are 32.3 x 10(exp -11) and 19.5 x 10(exp -11), respectively; while the rms about the mean values are 4.1 x 10(exp -11) and 6.3(10)(exp -11), respectively. The annual delta(J2) is in good agreement with the value obtained from the combined effects of air mass redistribution without the oceanic inverted-barometer effects and hydrological change. The annual delta(J3) values have much larger disagreements. Approximately 90 percent of the observed annual variation from Starlette is attributed to the meteorological mass redistribution occurring near the Earth's surface. D.R.D.

N92-21853 Wisconsin Univ., Madison.
A SURVEY FOR RAPID VARIABILITY AMONG EARLY MAIN SEQUENCE A-STARS Ph.D. Thesis
Randy L. Schutt 1991 292 p
Avail: Univ. Microfilms Order No. DA9128935

This thesis is a survey of non-peculiar early (A0 to A5) main sequence A-stars for rapid (4 to 30 minutes), low amplitude (less than 10 millimagnitudes) variability. Peculiar stars (roAp stars) are presently the only objects known to exhibit this behavior on or near the main sequence. There are also reasons for suspecting variability in normal stars; survey objects are in close proximity, in an Hertzsprung-Russell (HR) diagram, to the cepheid instability strip where many pulsational variables are found (i.e. the delta Scuti and roAp stars), and there is evidence of pulsational variability (at slightly longer periods) in the non-peculiar delta Scuti stars. The survey is also an independent test of the main sequence mass-loss theory proposed by Wilson et al. 1986. Finally, surveys of this type may produce objects of asteroseismological interest. The purpose of the survey is to detect variability, not to resolve all frequencies that may be involved. All observations were gathered with the University of Wisconsin Two-Star Photometer. This instrument coupled with computerized high-speed data collection used the small (16 to 24 in.) telescopes at Pine Bluff Observatory and Table Mountain Observatory. Several period-searching methods were used to analyze time series of differential photometric data. The survey produced a few stars suspected of variability, however, there is no evidence for large scale rapid variability among the non-peculiar main sequence A-stars. The survey also produced several low-amplitude delta Scuti stars, which are in or blueward of the recognized instability strip. These stars verify predictions that delta Scuti stars exist at lower amplitudes, and may also indicate they are present at earlier spectral types.
Dissert. Abstr.

N92-21885*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
COMPTEL: INSTRUMENT DESCRIPTION AND PERFORMANCE
J. W. denHerder, H. Aarts, K. Bennett, H. deBoer, M. Busetta, W. Collmar, A. Connors, R. Diehl, W. Hermsen, and J. Ryan (New Hampshire Univ., Durham.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 85-94 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21886*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
DATA ANALYSIS OF THE COMPTEL INSTRUMENT ON THE NASA GAMMA RAY OBSERVATORY
R. Diehl, K. Bennett, W. Collmar, A. Connors, J. W. denHerder, W. Hermsen, G. G. Lichti, J. A. Lockwood, J. Macri, and M. McConnell (New Hampshire Univ., Durham.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 95-101 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21889*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE EGRET HIGH ENERGY GAMMA RAY TELESCOPE
R. C. Hartman, D. L. Bertsch, C. E. Fichtel, S. D. Hunter, G. Kanbach, D. A. Kniffen, P. W. Kwok, Y. C. Lin, J. R. Mattox, and H. A. Mayer-Hasselwander (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) et al *In its* The Compton Observatory Science Workshop Feb. 1992 p 116-125 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21892*# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
NEW OBSERVATIONS WITH THE GAMMA RAY IMAGER SIGMA
J. P. Roques and G. Vedrenne *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 145-157 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21929*# Michigan Univ., Ann Arbor.
STATUS OF THE WHIPPLE OBSERVATORY CERENKOV AIR SHOWER IMAGING TELESCOPE ARRAY
C. W. Akerlof, M. F. Cawley, D. J. Fegan, S. Fennell, S. Freeman, D. Frishman, K. Harris, A. M. Hillas, D. Jennings, and R. C. Lamb (Iowa State Univ. of Science and Technology, Ames.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 406-411 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N92-21096# Amsterdam Univ. (Netherlands). Inst. for Theoretical Physics.
NEUTRINO DRIVEN NEUTRON STAR FORMATION Ph.D. Thesis
Jan Cernohorsky (Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands) 1991 120 p (ETN-92-91038) Avail: NTIS HC/MF A06

The simulation of the neutrino driven neutron star formation is presented. Neutrino transport is a key subject to understand supernovae and neutron star formation. To study neutrino transport phenomena, Flux Limited Diffusion (FLD) methods are chosen. These methods solve the energy balance equation, which is the angular integral of the Boltzmann equation. The Flux-limited Neutrino Diffusion Theory (FNDT), the FLD approach, is presented. It is conceptually superior in the sense that it can be systemically derived from the Boltzmann equation, with total control over all necessary assumptions made in its derivation. The FNDT is implemented in a computer code and used to simulate neutrino transport in dense static stellar backgrounds. The stellar background is made dynamic, and two model neutron star formation simulations employing FNDT are presented. For individual titles, see N92-21097 through N92-21100.

N92-21097# Amsterdam Univ. (Netherlands). Inst. for Theoretical Physics.
MAXIMUM ENTROPY EDDINGTON FACTORS IN FLUX-LIMITED NEUTRINO DIFFUSION
Jan Cernohorsky, L. J. vandenHorn, and J. Cooperstein (Brookhaven National Lab., Upton, NY.) *In its* Neutrino Driven Neutron Star Formation 1991 p 9-19 Repr. from J. Quant.

Spectrosc. Radiat. Transfer, v. 42, no. 6, 1989 p 603-613 (For primary document see N92-21096 12-90)
Avail: NTIS HC/MF A06

A neutrino transport scheme for use in dense stellar environments and collapsing stars is constructed. The maximum entropy principle is used to establish the general form of the angular neutrino distribution functions. The two Lagrange multipliers introduced by this procedure are determined by using the Flux-limited Diffusion Theory (FDT) of Levermore and Pomraning. The anisotropic scattering contribution is taken into account. Its inclusion leads to a modification of the Levermore-Pomraning approach. The transition from a multigroup to an energy integrated transport scheme for FDT is investigated. The link to the two fluid model of Cooperstein et al is made. This extended two fluid model parametrizes the thermal and chemical disequilibrium between matter and neutrinos. The variable Eddington factors are now self-consistently determined through a local dimensionless quantity, rather than by macroscopic geometrical prescription. ESA

N92-21098# Amsterdam Univ. (Netherlands). Inst. for Theoretical Physics.
ON GAUGE FREEDOM IN FLUX-LIMITED DIFFUSION THEORY
Jan Cernohorsky and L. J. vandenHorn (Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands) *In its* Neutrino Driven Neutron Star Formation 1991 p 21-26 Repr. from J. Quant. Spectrosc. Radiat. Transfer, v. 43, no. 1, 1990 p 33-38 (For primary document see N92-21096 12-90)
Avail: NTIS HC/MF A06

The approximation made in the derivation of the Levermore and Pomraning (LP) Flux limited Diffusion Theory (FDT) is investigated and resulting inconsistencies are noted. An inconsistency arising in the original formulation at the level of the first angular moment of the transport equations is removed. This correction leaves the practical results of the FDT untouched. A gauge freedom in the central assumption is established. Modifications of a standard assumption are proposed and their consequences discussed. Incorporation of these modifications is shown to enhance the self consistency of the LP method. The approach presented exploits gauge freedom in the central assumption. This fact makes it possible to attain consistency with the conventional diffusion approximation, while retaining the maximum entropy structure of the angular distribution and associated algebraic flux limiter. The second angular moment of the auxilliary condition can be interpreted as a quantitative expression for the error made in the momentum balance when FDT is implemented in practical calculations. ESA

N92-21099# Amsterdam Univ. (Netherlands). Inst. for Theoretical Physics.
FLUX-LIMITED NEUTRINO DIFFUSION IN STATIC STELLAR BACKGROUNDS
Jan Cernohorsky (Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands) *In its* Neutrino Driven Neutron Star Formation 1991 p 27-74 (For primary document see N92-21096 12-90)
Avail: NTIS HC/MF A06

The numerical implementation of multigroup Levermore-Pomraning Flux Limited Neutrino Diffusion Theory (FNDT) is presented. The behavior of this transport scheme is investigated in five static stellar models. In the calculations the feedback of the neutrino flow on the stellar matter is neglected. The evolution of the neutrino energy distribution function is followed in time, starting from an initial Local Thermodynamic Equilibrium (LTE) distribution throughout the star, until a stationary non LTE solution is reached. Spectral and frequency integrated sources, luminosities and distributions are presented. The influence of electron degeneracy on the neutrino transport is highlighted. Energy deposition in regions of the stellar models relevant to the delayed explosion mechanism is rule rather than exception. Absorption of high energy neutrinos w greater than 20 MeV depletes the high energy end of the spectrum at densities ranging down to n(10 to the 9th power) g/cubic cm. In order to simulate spectra seen by an observer at infinity, it is necessary to extend the transport calculation to this density. Emergent neutrino energy distributions are typically nonthermal. Thermal fits can be made only on the high energy tail of the spectrum. The use of fitting parameters in the evaluation of bulk luminosities may overestimate these by factors of several. ESA

N92-21100# Amsterdam Univ. (Netherlands). Inst. for Theoretical Physics.
FLUX-LIMITED NEUTRINO DIFFUSION IN NEUTRON STAR FORMATION
Jan Cernohorsky and J. C. Vink (Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands) *In its* Neutrino Driven Neutrino Star Formation 1991 p 75-112 (For primary document see N92-21096 12-90)
Avail: NTIS HC/MF A06

A neutron star evolution simulation which utilizes the Flux limited Neutrino Diffuse Theory (FNDT) transport code reported previously is presented. The mu(sub e) and mu bar(sub e) transport is spectral and monochromatic. The evolution of two protoneutron star models is simulated for 30 and 10 sec, respectively. In the first stellar model, the neutrino flows deposit a substantial amount of energy, about 3 x 10(exp 49) erg, during the first tenths of a second at matter densities around and below 5 x 10(exp 10) g/cu cm. Initially, this causes the star to expand. In the second model nuclei are added to the composition of the star in the relevant regions to investigate the qualitative effect of the modified opacities on the deposition. It is found that the inclusion of nuclei impedes the expansion. The energy deposition by the neutrino flows in the outer regions of the star slows down the contraction of the atmosphere in both models considerably, and over many seconds. After about 1 sec a density inversion develops at the edge of the dense inner core at rho approx. = 10(exp 13) g cu cm in both models. This density inversion is very likely to be unstable against convection. Both the energy deposition in the outer regions of the star and the density inversion at the edge of the inner core may have some effect on the working of the delayed explosion mechanism. ESA

N92-21102# International Centre for Theoretical Physics, Trieste (Italy).
ALFVEN SOLITONS IN A DENSE ULTRARELATIVISTIC ELECTRON-POSITRON PULSAR PLASMA
U. A. Mofiz Jul. 1991 9 p
(DE92-614465; IC-91/178) Avail: NTIS HC/MF A02

The nonlinear propagation of Alfven wave in a hot electron-positron plasma of a pulsar magnetosphere is investigated. Alfven solitons are found to exist at ultrarelativistic (T much greater than mc(exp 2)) temperature. Landau damping and three dimensional modulation perturbation of solitons are discussed. DOE

N92-21200# Louisiana State Univ., Baton Rouge. Dept. of Physics and Astronomy.
NUCLEAR INTERACTIONS OF HIGH ENERGY HEAVY IONS AND APPLICATIONS IN ASTROPHYSICS
J. P. Wefel 23 Jan. 1992 27 p
(Contract DE-FG05-84ER-40147)
(DE92-007707; DOE/ER-40147/10) Avail: NTIS HC/MF A03

This program was established for the purpose of studying projectile fragmentation: (1) as a function of energy, focusing first on the intermediate energy region, less than 1 GeV/nucleon, where there have been few previous measurements and no systematic studies, and (2) as a function of projectile mass, starting with light beams and proceeding to species as heavy as nickel (and possibly beyond). The intermediate energy region is important as the transition between the lower energy data, where the interaction appears to be dominated by collective effects and the decay of excited nuclei, and the highest energy results, where nucleon-nucleon interactions are fundamental, 'limiting fragmentation' applies, and the nucleus may well break-up before any de-excitation. The mass dependence of projectile fragmentation is largely unknown since most detailed work has involved light ion beams. Nuclear structure effects, for example, may well be quite

prominent for heavier beams. Furthermore, the nuclear excitation functions for the production of different fragment isotopes have immediate application to the astrophysical interpretation of existing isotopic datasets obtained from balloon and satellite measurements of galactic cosmic rays. DOE

N92-21215*# California Univ., Los Angeles. Dept. of Astronomy.
CARBON STARS WITH OXYGEN-RICH CIRCUMSTELLAR MATERIAL
Michael Jura and I. Hawkins (California Univ., Berkeley.) 16 Jan. 1991 25 p
(Contract NAS5-30180; NAG5-1406)
(NASA-CR-190161; NAS 1.26:190161) Avail: NTIS HC/MF A03 CSCL 03B

The IUE satellite was used to search for companions to two carbon-rich stars with oxygen-rich circumstellar envelopes, EU And and V778 Cyg. Depending upon the amount of interstellar extinction and distances (probably between 1 and 2 kpc from the Sun) to these two stars, upper limits were placed between approx. 1.5 and 6 solar mass to the mass of any main sequence companions. For the 'near' distance of 1 kpc, it seems unlikely that there are white dwarf companions because the detection would be expected of ultraviolet emission from accretion of red giant wind material onto the white dwarf. A new model is proposed to explain the oxygen-rich envelopes. If these stars have a high nitrogen abundance, the carbon that is in excess of the oxygen may be carried in the circumstellar envelopes in HCN rather than C2H2 which is a likely key seed molecule for the formation of carbon grains. Consequently, carbon particles may not form; instead, oxygen-rich silicate dust may nucleate from the SiO present in the outflow. Author

N92-21288 Texas Univ., Austin.
THE CHARGED BLACK HOLE IN A COSMOLOGICAL CONTEXT Ph.D. Thesis
Roberto Vincenzo Bruno 1991 58 p
Avail: Univ. Microfilms Order No. DA9128170

The structure of the spacetime obtained from the embedding of the region between the event horizon and the Cauchy horizon of the Reissner-Nordstroem solution in a closed cosmology is investigated. It is shown that this model incorporates the spherically symmetric solution of the coupled Einstein and Maxwell's equations in a cosmological model in the same way a similar construction by Qadir and Wheeler incorporates the Schwarzschild solution in a cosmological model with S(exp 3) topology. The fate of the suture universe obtained is discussed. Dissert. Abstr.

N92-21289# Erlangen-Nuremberg Univ. (Germany, F.R.). Naturwissenschaftlich Fakultaet.
NUMERICAL EXAMINATIONS OF THE STRUCTURES IN THE DUST TAIL OF A COMET Ph.D. Thesis [NUMERISCHE UNTERSUCHUNGEN VON STRUKTUREN IM STAUBSCHWEIF EINES KOMETEN]
Klaus Beisser Jul. 1990 227 p In GERMAN
(ETN-92-90831) Avail: NTIS HC/MF A11

The consequences of the variation of comet nucleus emission characteristics on the shape of the dust tail are examined. Additionally, the emitted dust quantity is deduced from the dust tail image. The concept behind the process and the resulting algorithm are represented and discussed in detail. Other methods are also examined. The effects that the rotation of the comet nucleus have on the dust tail are examined. Test examinations using the method, which allow the possibilities of back circuits on the behavior of a comet dust emission, are presented. ESA

N92-21407*# Fermi National Accelerator Lab., Batavia, IL.
COSMOLOGICAL TEXTURE IS INCOMPATIBLE WITH PLANCK-SCALE PHYSICS
Richard Holman, Stephen D. H. Hsu, Edward W. Kolb, Richard Watkins, and Lawrence M. Widrow (California Univ., Santa Barbara.) Jan. 1992 12 p Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA, Harvard Univ., Cambridge, MA, and Toronto Univ., Ontario
(Contract NAGw-2381; DE-AC02-76ER-03066; NSF PHY-89-04035; NSF PHY-87-14654; TNRLC-RGFY106)
(NASA-CR-190120; NAS 1.26:190120; NSF-ITP-92-04; CMU-HEP92-04; FNAL-PUB-92/32-A; HUTP-92A010) Avail: NTIS HC/MF A03 CSCL 03B

Nambu-Goldstone modes are sensitive to the effects of physics at energies comparable to the scale of spontaneous symmetry breaking. We show that as a consequence of this the global texture proposal for structure formation requires rather severe assumptions about the nature of physics at the Planck scale. Author

N92-21425 Cincinnati Univ., OH.
A DYNAMICALLY-CONSISTENT NUMERICAL THEORY FOR THE LONG-TERM ROTATIONAL MOTION OF THE QUASI-RIGID EARTH Ph.D. Thesis
Charles Franklin Walker, Jr. 1991 92 p
Avail: Univ. Microfilms Order No. DA9205485

A numerical theory for the long-term rotational motion of the quasi-rigid Earth has been constructed. The theory spans 72,000 years centered about 1968 A.D. The Earth model used is termed dynamically consistent because of expressions for the forces and torques acting upon the Earth are truncated based upon their magnitude regardless of their cause. The model used includes torques due to geopotential and tidal effects, and the truncation of the force and torque series results in a quasi-rigid Earth model. Quasi-rigidity implies that the tidal torques and forces are included in the model, but tidal effects on the mass properties of the Earth are not. Both lunisolar and planetary effects on the rotation are considered. The data generated by the numerical integration has been fitted using Chebyshev polynomial series in order make solution more compact and usable. The solution for obliquity, precession, and other parameters which affect the Earth's climate are presented graphically. Dissert. Abstr.

N92-21463 Alabama Univ., Birmingham.
AN EXPERIMENTAL STUDY OF POLYCYCLIC AROMATIC HYDROCARBONS AS THE EMITTERS OF THE COSMIC UNIDENTIFIED INFRARED BANDS Ph.D. Thesis
Gregory Charles Flickinger 1991 162 p
Avail: Univ. Microfilms Order No. DA9134228

This research investigates the dependence of the mid-infrared absorption spectra of polycyclic aromatic hydrocarbons (PAHs) on temperature in the condensed state and in the vapor phase. The initial experiment demonstrated that coronene's spectrum underwent significant temporary changes with temperature increase. This included a change of the complex profile due to the aromatic C-H stretch due to a simpler profile that is very similar to that of the 3.3 micro-m cosmic unidentified infrared (UIR) emission. This unknown spectral change is reversible. The elevated temperature may duplicate the condition of an interstellar PAH molecule that has been temporarily vibrationally excited by the absorption of an ultraviolet photon. Further experiments with a variety of PAH species indicate that the phenomenon observed for corenene is a general one. For all PAHs studied in the condensed state, the usually complex profile of the 3.3 micro-m absorption feature at 300 K can be temporarily changed to a single peak of enhanced strength, similar to the 3.3 micro-m UIR emission profile, by heating to some specific elevated temperature. In addition, there is a distinct difference in the peak absorption wavelength between the two classes of PAHs studied, compact and noncompact. The compact species gives the best peak wavelength match to the interstellar feature, which is consistent with the hypothesis that, because compact PAHs are most resistent to destruction in the interstellar ultraviolet radiation field, they are the most abundant PAH species in the interstellar medium. Gas phase temperature elevation experiments have been performed and have demonstrated a temperature dependence of the 3.3 micro-m (3040 cm(exp -1)) PAH absorption feature that is similar to that seen for PAH in KBr pellets. However, the C-H aromatic stretch feature appears to peak at a significantly higher frequency, or shorter wavelength, than both the condensed state PAHs and the 3.3 micr-m UIR feature, suggesting that much of the interstellar

PAHs may not be in the gas phase. The 3.3 micro-m peak's wavelength dependence on the PAH phase may provide important information related to the state of interstellar PAH emitter, with implications for theories regarding the mechanism of the UIR emissions. Dissert. Abstr.

N92-21874*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE COMPTON OBSERVATORY SCIENCE WORKSHOP
Chris R. Shrader, ed. (Computer Sciences Corp., Beltsville, MD.), Neil Gehrels, ed., and Brian Dennis, ed. Washington Feb. 1992 552 p Workshop held in Annapolis, MD, 23-25 Sep. 1991
(NASA-CP-3137; Rept-92B00035; NAS 1.55:3137) Avail: NTIS HC/MF A24 CSCL 03B

The Compton Observatory Science Workshop was held in Annapolis, Maryland on September 23-25, 1991. The primary purpose of the workshop was to provide a forum for the exchange of ideas and information among scientists with interests in various areas of high energy astrophysics, with emphasis on the scientific capabilities of the Compton Observatory. Early scientific results, as well as reports on in-flight instrument performance and calibrations are presented. Guest investigator data products, analysis techniques, and associated software were discussed. Scientific topics covered included active galaxies, cosmic gamma ray bursts, solar physics, pulsars, novae, supernovae, galactic binary sources, and diffuse galactic and extragalactic emission. For individual titles, see N92-21875 through N92-21950.

N92-21875*# Universities Space Research Association, Washington, DC.
OPERATION AND PERFORMANCE OF THE OSSE INSTRUMENT
R. A. Cameron, J. D. Kurfess, W. N. Johnson, R. L. Kinzer, R. A. Kroeger, M. D. Leising, R. J. Murphy, G. H. Share, M. S. Strickman, and J. E. Grove (Naval Research Lab., Washington, DC.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 3-14 Prepared in cooperation with Northwestern Univ., Evanston, IL; and Clemson Univ., SC (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Oriented Scintillation Spectrometer Experiment (OSSE) on the Arthur Holly Compton Gamma Ray Observatory is described. An overview of the operation and control of the instrument is given, together with a discussion of typical observing strategies used with OSSE and basic data types produced by the instrument. Some performance measures for the instrument are presented that were obtained from pre-launch and in-flight data. These include observing statistics, continuum and line sensitivity, and detector effective area and gain stability. Author

N92-21876*# Northwestern Univ., Evanston, IL.
OSSE SPECTRAL ANALYSIS TECHNIQUES
W. R. Purcell, K. M. Brown, D. A. Grabelsky, W. N. Johnson, G. V. Jung, R. L. Kinzer, R. A. Kroeger, J. D. Kurfess, S. M. Matz, and M. S. Strickman (Naval Research Lab., Washington, DC.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 15-25 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Analysis of the spectra from the Oriented Scintillation Spectrometer Experiment (OSSE) is complicated because of the typically low signal to noise (approx. 0.1 percent) and the large background variability. The OSSE instrument was designed to address these difficulties by periodically offset-pointing the detectors from the source to perform background measurements. These background measurements are used to estimate the background during each of the source observations. The resulting background-subtracted spectra can then be accumulated and fitted for spectral lines and/or continua. Data selection based on various environmental parameters can be performed at various stages during the analysis procedure. In order to achieve the instrument's statistical sensitivity, however, it will be necessary for investigators to develop a detailed understanding of the instrument operation, data collection, and the background spectrum and its variability. A brief description of the major steps in the OSSE spectral analysis process is described, including a discussion of the OSSE background spectrum and examples of several observational strategies. Author

N92-21877*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE BATSE EXPERIMENT ON THE COMPTON GAMMA RAY OBSERVATORY: STATUS AND SOME EARLY RESULTS
G. J. Fishman, C. A. Meegan, R. B. Wilson, W. S. Paciesas, and G. N. Pendleton (Alabama Univ., Huntsville.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 26-34 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (GRO) is a sensitive all-sky detector system. It consists of eight uncollimated detectors at the corners of the spacecraft which have a total energy range of 15 keV to 100 MeV. The primary objective of BATSE is the detection, location, and study of gamma ray bursts and other transient sources. The instrement also has considerable capability for the study of pulsars, solar flares, and other discrete high energy sources. The experiment is now in full operation, detecting about one gamma ray burst per day. A brief description of the on-orbit performance of BATSE is presented, along with examples of early results from some of the gamma ray bursts. Author

N92-21878*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
LONG-TERM SOURCE MONITORING WITH BATSE
R. B. Wilson, B. A. Harmon, M. H. Finger, G. J. Fishman, C. A. Meegan, and W. S. Paciesas (Alabama Univ., Huntsville.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 35-46 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The uncollimated Burst and Transient Source Experiment (BATSE) large area detectors (LADs) are well suited to nearly continuous monitoring of the stronger hard x-ray sources, and time series analysis for pulsars. An overview of the analysis techniques presently being applied to the data are discussed, including representative observations of the Crab Nebula, Crab pulsar, and summaries of the sources detected to data. Results of a search for variability in the Crab Pulsar pulse profile are presented. Author

N92-21879*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PRELIMINARY CALIBRATION RESULTS FOR THE BATSE INSTRUMENT ON CGRO
G. N. Pendleton, W. S. Paciesas (Alabama Univ., Huntsville.), G. J. Fishman, R. B. Wilson, C. A. Meegan, F. E. Roberts, J. P. Lestrade, J. M. Horack, M. N. Brock, and M. D. Flickinger et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 47-52 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Preliminary results pertaining to spectral reconstruction using Burst and Transient Source (BATSE) Large Area Detector measurements of solar flares are presented. The solar flare measurements are currently being used to fine tune the calibration of our data analysis software. The current status of the stability of spectral analysis, given the systematic errors present in burst location, are given. A brief description is given of enhancements to the input data for the atmospheric scattering algorithm that will be implemented in the data analysis software. Author

N92-21880*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
BATSE SPECTROSCOPY ANALYSIS SYSTEM

Bradley E. Schaefer, Sandhia Bansal, Anju Basu, Phil Brisco, Thomas L. Cline, Elliott Friend, Nancy Laubenthal, E. S. Panduranga, Nuru Parkar, and Brad Rust et al *In its* The Compton Observatory Science Workshop Feb. 1992 p 53-59 Prepared in cooperation with NASA. Marshall Space Flight Center; and California Univ., San Diego, La Jolla (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Burst and Transient Source Experiment (BATSE) Spectroscopy Analysis System (BSAS) is the software system which is the primary tool for the analysis of spectral data from BATSE. As such, Guest Investigators and the community as a whole need to know its basic properties and characteristics. Described here are the characteristics of the BATSE spectroscopy detectors and the BSAS. Author

N92-21881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GAMMA RAY BURST SOURCE LOCATIONS WITH THE NEW INTERPLANETARY NETWORK Abstract Only **c93**
T. L. Cline, Gerald Fishman, Kevin Hurley, John Laros, Neils Lund, and Michael Sommer (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 60 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The celestial source fields of gamma ray bursts can now be determined with precision considerably greater than that provided by earlier interplanetary networks. A new burst timing array consists of the Ulysses mission and the Pioneer-Venus Orbiter at great distances and the Compton Observatory, Granat, and other burst-observing spacecraft near the Earth. With Ulysses providing a baseline approaching five astronomical units in its progress towards Jupiter, and given the timing resolution of the Compton Burst and Transient Source Experiment, source fields with dimensions as small as several arc seconds by less than one arc minute will be determined for many of the events to be studied within this network. Author

N92-21882*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
DESCRIPTION OF A SUBSET OF SINGLE EVENTS FROM THE BATSE GAMMA RAY BURST DATA **c93**
Chryssa Kouveliotou, William S. Paciesas (Alabama Univ., Huntsville.), Gerald J. Fishman, Charles A. Meegan, and Robert B. Wilson *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 61-68 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

About 15 percent of the gamma ray bursts in the Burst and Transient Source Experiment (BATSE) data exhibit a simple light curve consisting mainly of a single pulse without fine substructures. In 12 of the burst profiles, the pulse shapes show a linear rise and decay. Three events have a distinct sharp rise followed by a long, almost exponential decay. Searches based on only a sharp rise selection criterion resulted in five more grbs with different profile complexities. In one case, we identify an envelope of fast oscillations with a long, softer tail lasting about 100 seconds. The majority of events were detectable at energies above 300 keV, with tentative estimates for fluences that vary between 4.0 x 10(exp -8) and 5.4 x 10(exp -6) ergs/sq cm. We describe here their general characteristics (durations, rise-decay times) and their hardness ratios. Author

N92-21883*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
OCCULTATION ANALYSIS OF BATSE DATA: OPERATIONAL ASPECTS **c93**
B. A. Harmon, M. H. Finger, B. Rubin, R. Mallozzi, W. S. Paciesas (Alabama Univ., Huntsville.), R. B. Wilson, G. J. Fishman, M. Brock, and C. A. Meegan *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 69-75 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Burst and Transient Source Experiment (BATSE) large area detectors are being used to monitor hard x-ray/gamma ray sources on a daily basis for evidence of transient behavior. Flux measurements are performed using a simple earth occultation technique. Daily searches are also being performed to detect occultation steps of sources which are not being routinely monitored. Topics concerning the operational aspects of the occultation measurements are presented. Preliminary spectral results are also presented for several of the brighter sources. Author

N92-21884*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
SCIENTIFIC OBJECTIVES AND FIRST RESULTS FROM COMPTEL
V. Schoenfelder, K. Bennett, H. Bloemen, H. deBoer, M. Busetta, W. Collmar, A. Connors, R. Diehl, J. W. denHerder, and W. Hermsen (Leiden Univ., Netherlands) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 76-84 Prepared in cooperation with New Hampshire Univ., Durham (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The imaging Compton telescope (COMPTEL) is the first imaging telescope in space to explore the MeV gamma ray range. At present it is performing a complete sky survey. In later phases of the mission, selected celestial objects will be studied in more detail. Targets of special interest in the COMPTEL energy range are radio pulsars, X-ray binaries, novae, supernova remnants, molecular clouds, and the interstellar medium within the Milky Way, as well as the nuclei of active galaxies, supernovae, and the diffuse cosmic background radiation in extragalactic space. The first four months of operation demonstrated that COMPTEL basically performs as expected. The Crab is clearly seen at its proper position in the first images of the anticenter region of the Galaxy. The Crab pulsar lightcurve was measured with unprecedented accuracy. The quasar 3C273 was seen for the first time at MeV-energies. Several cosmic bursts within the COMPTEL field of view could be located to an accuracy of about 1 degree. On June 9, 11, and 15, 1991 COMPTEL observed gamma ray (continuum and line) emission from three solar flares. Neutrons were also detected from the June 9 flare. At the present state of analysis, COMPTEL achieves the prelaunch predictions of its sensitivity within a factor of 2. Based on the present performance of COMPTEL, the team is confident that COMPTEL will fulfill its primary mission of surveying and exploring the MeV sky. Author

N92-21885*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
COMPTEL: INSTRUMENT DESCRIPTION AND PERFORMANCE **c89**
J. W. denHerder, H. Aarts, K. Bennett, H. deBoer, M. Busetta, W. Collmar, A. Connors, R. Diehl, W. Hermsen, and J. Ryan (New Hampshire Univ., Durham.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 85-94 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The imaging Compton telescope (COMPTEL) is one of the four gamma ray detectors aboard the Compton Gamma Ray Observatory (GRO). COMPTEL is sensitive to gamma rays from 800 keV to 30 MeV with a field of view of approximately 1 sr. Its angular resolution ranges between 1 and 2 degrees depending on the energy and incidence angle. The energy resolution of better than 10 percent FWHM enables COMPTEL to provide spectral resolution in the regime of astrophysical nuclear lines. The effective area varies typically from 10 to 50 cm(exp 2) depending on the energy and event selections made. In its telescope mode, COMPTEL is able to study a wide variety of objects, pointlike as well as extended in space. With 0.125 msec timing resolution, pulsed emission can be studied. In the single detector mode, COMPTEL uses two of its detectors to study the temporal spectral evolution of strong gamma ray bursts or transients. Author

N92-21886*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).

DATA ANALYSIS OF THE COMPTEL INSTRUMENT ON THE NASA GAMMA RAY OBSERVATORY **c89**

R. Diehl, K. Bennett, W. Collmar, A. Connors, J. W. denHerder, W. Hermsen, G. G. Lichti, J. A. Lockwood, J. Macri, and M. McConnell (New Hampshire Univ., Durham.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 95-101 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

The Compton imaging telescope (COMPTEL) on the Gamma Ray Observatory (GRO) is a wide field of view instrument. The coincidence measurement technique in two scintillation detector layers requires specific analysis methods. Straightforward event projection into the sky is impossible. Therefore, detector events are analyzed in a multi-dimensional dataspace using a gamma ray sky hypothesis convolved with the point spread function of the instrument in this dataspace. Background suppression and analysis techniques have important implications on the gamma ray source results for this background limited telescope. The COMPTEL collaboration applies a software system of analysis utilities, organized around a database management system. The use of this system for the assistance of guest investigators at the various collaboration sites and external sites is foreseen and allows different detail levels of cooperation with the COMPTEL institutes, dependent on the type of data to be studied. Author

N92-21887*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).

NEUTRON INDUCED BACKGROUND IN THE COMPTEL DETECTOR ON THE GAMMA RAY OBSERVATORY

D. J. Morris, H. Aarts, K. Bennett, M. Busetta, R. Byrd, W. Collmar, A. Connors, R. Diehl, G. Eymann, and C. Foster (Indiana Univ., Bloomington.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 102-108 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

Interactions of neutrons in a prototype of the Compton imaging telescope (COMPTEL) gamma ray detector for the Gamma Ray Observatory were studied to determine COMPTEL's sensitivity as a neutron telescope and to estimate the gamma ray background resulting from neutron interactions. The IUCF provided a pulsed neutron beam at five different energies between 18 and 120 MeV. These measurements showed that the gamma ray background from neutron interactions is greater than previously expected. It was thought that most such events would be due to interactions in the upper detector modules of COMPTEL and could be distinguished by pulse shape discrimination. Rather, the bulk of the gamma ray background appears to be due to interactions in passive material, primarily aluminum, surrounding the D1 modules. In a considerable fraction of these interactions, two or more gamma rays are produced simultaneously, with one interacting in the D1 module and the other interacting in the module of the lower (D2) detector. If the neutron interacts near the D1 module, the D1 D2 time of flight cannot distinguish such an event from a true gamma ray event. In order to assess the significance of this background, the flux of neutrons in orbit has been estimated based on observed events with neutron pulse shape signature in D1. The strength of this neutron induced background is estimated. This is compared with the rate expected from the isotropic cosmic gamma ray flux. Author

N92-21888*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

COMPTEL NEUTRON RESPONSE AT 17 MeV

Terrence J. ONeill, Farid Ait-Ouamer, Joann Morris, O. Tumay Tumer, R. Stephen White, and Allen D. Zych *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop, Feb. 1992 p 109-115 Prepared in cooperation with Riverside Community Coll., CA (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

The Compton imaging telescope (COMPTEL) instrument of the Gamma Ray Observatory was exposed to 17 MeV d,t neutrons prior to launch. These data were analyzed and compared with Monte Carlo calculations using the MCNP(LANL) code. Energy and angular resolutions are compared and absolute efficiencies are calculated at 0 and 30 degrees incident angle. The COMPTEL neutron responses at 17 MeV and higher energies are needed to understand solar flare neutron data. Author

N92-21889*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

THE EGRET HIGH ENERGY GAMMA RAY TELESCOPE **c89**

R. C. Hartman, D. L. Bertsch, C. E. Fichtel, S. D. Hunter, G. Kanbach, D. A. Kniffen, P. W. Kwok, Y. C. Lin, J. R. Mattox, and H. A. Mayer-Hasselwander (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) et al *In its* The Compton Observatory Science Workshop Feb. 1992 p 116-125 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

The Energetic Gamma Ray Experiment Telescope (EGRET) on the Compton Gamma Ray Observatory (GRO) is sensitive in the energy range from about 20 MeV to about 30,000 MeV. Electron-positron pair production by incident gamma photons is utilized as the detection mechanism. The pair production occurs in tantalum foils interleaved with the layers of a digital spark chamber system; the spark chamber records the tracks of the electron and positron, allowing the reconstruction of the arrival direction of the gamma ray. If there is no signal from the charged particle anticoincidence detector which surrounds the upper part of the detector, the spark chamber array is triggered by two hodoscopes of plastic scintillators. A time of flight requirement is included to reject events moving backward through the telescope. The energy of the gamma ray is primarily determined by absorption of the energies of the electron and positron in a 20 cm deep NaI(Tl) scintillator. Author

N92-21890*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

THE EGRET DATA PRODUCTS

J. R. Mattox, D. L. Bertsch, C. E. Fichtel, R. C. Hartman, S. D. Hunter, G. Kanbach, D. A. Kniffen, P. W. Kwok, Y. C. Lin, and H. A. Mayer-Hasselwander (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) et al *In its* The Compton Observatory Science Workshop Feb. 1992 p 126-136 Prepared in cooperation with Grumman Aerospace Corp., Bethpage, NY; Computer Sciences Corp., Greenbelt, MD; and Universities Space Research Association, Greenbelt, MD (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

We describe the Energetic Gamma Ray Experiment Telescope (EGRET) data products which we anticipate will suffice for virtually all guest and archival investigations. The production process, content, availability, format, and the associated software of each product is described. Supplied here is sufficient detail for each researcher to do analysis which is not supported by extant software. Author

N92-21891*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

NEURAL NETWORK CLASSIFICATION OF QUESTIONABLE EGRET EVENTS **c93**

C. A. Meetre and J. P. Norris *In its* The Compton Observatory Science Workshop Feb. 1992 p 137-144 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

High energy gamma rays (greater than 20 MeV) pair producing in the spark chamber of the Energetic Gamma Ray Telescope Experiment (EGRET) give rise to a characteristic but highly variable 3-D locus of spark sites, which must be processed to decide whether the event is to be included in the database. A significant fraction (about 15 percent or 10(exp 4) events/day) of the candidate events cannot be categorized (accept/reject) by an automated rule-based procedure; they are therefore tagged, and must be

examined and classified manually by a team of expert analysts. We describe a feedforward, back-propagation neural network approach to the classification of the questionable events. The algorithm computes a set of coefficients using representative exemplars drawn from the preclassified set of questionable events. These coefficients map a given input event into a decision vector that, ideally, describes the correct disposition of the event. The net's accuracy is then tested using a different subset of preclassified events. Preliminary results demonstrate the net's ability to correctly classify a large proportion of the events for some categories of questionables. Current work includes the use of much larger training sets to improve the accuracy of the net. Author

N92-21892*# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
NEW OBSERVATIONS WITH THE GAMMA RAY IMAGER SIGMA **c89**
J. P. Roques and G. Vedrenne *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 145-157 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Results from the use of the gamma ray telescope SIGMA are given. An identification and an extensive study was done of sources contributing to the emission of the Galactic center region above 30 keV. A strong line was observed at 480 keV from Nova Muscae, which may be interpreted as an annihilation line with a redshift due to the presence of a compact object. The soft x-ray tails observed by SIGMA in some transient sources already identified as soft x-ray transients might be a common characteristic of these objects and has to be explained. The unusual spectrum of NGC4151 with a break around 50 keV can characterize a particular state of this kind of object. If it is the case, it has interesting implications for the origin of the Cosmic Diffuse Background. Author

N92-21893*# New Mexico State Univ., Las Cruces.
OPTICAL MONITORING OF GRO PHASE 1 OBJECTS
Bernard McNamara, Jack Burns, and William Webber *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 158-163 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

A brief overview is given of the three phases of our Gamma Ray Observatory (GRO) optical monitoring program. The acquisition of simultaneous GRO/optical data on targeted Oriented Scintillation Spectrometer Experiment (OSSE) objects, the collection of noncoincident observations of suspected GRO gamma ray emitters to determine their level of activity, and the optical imaging of burst fields in an attempt to identify the burst source are discussed. Finally, a table of future simultaneous optical observations of Phase 1 GRO targets is presented along with plans for the rapid optical imaging of gamma ray burst fields. Author

N92-21894*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE PHASE 2 NRA
Eric Chipman *In its* The Compton Observatory Science Workshop Feb. 1992 p 164-170 Prepared in cooperation with Computer Sciences Corp., Greenbelt, MD (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We present points of special interest to potential proposers for the Compton Observatory Phase 2 Guest Investigator (GI) program. A general summary of some of the most important details of the phase 2 NASA Research Announcement (NRA) is followed by an enumeration of the modes of participation and proposal types available to GI proposers. Finally, the method which is planned for the selection of the Phase 2 Guest Investigators in parallel with the development of a preliminary Phase 2 observing timeline is outlined. The ways in which the selection of targets by GI's could be affected by the Phase 2 timeline development procedure is described. Author

N92-21895*# Rice Univ., Houston, TX. Dept. of Space Physics and Astronomy.
SOFT GAMMA RAYS FROM BLACK HOLES VERSUS NEUTRON STARS **c93**
Edison P. Liang *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 173-184 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The recent launches of GRANAT and GRO provide unprecedented opportunities to study compact collapsed objects from their hard x ray and gamma ray emissions. The spectral range above 100 keV can now be explored with much higher sensitivity and time resolution than before. The soft gamma ray spectral data is reviewed of black holes and neutron stars, radiation, and particle energization mechanisms and potentially distinguishing gamma ray signatures. These may include soft x ray excesses versus deficiencies, thermal versus nonthermal processes, transient gamma ray bumps versus power law tails, lines, and periodicities. Some of the highest priority future observations are outlines which will shed much light on such systems. Author

N92-21896*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MONITORING CEN X-3 WITH BATSE **c93**
Mark H. Finger, Robert B. Wilson, Charles A. Meegan, William S. Paciesas (Alabama Univ., Huntsville.), and Gerald J. Fishman *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 185-192 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The eight uncollimated BATSE Large Area Detectors (LAD's) provide the ability to monitor pulsed hard x ray sources on a nearly continuous basis. Using data from the LAD's, the pulse timing and pulsed flux of the 4.8 second period binary x ray pulsar Centaurus X-3 was analyzed over a two month period. The methods and initial results of this analysis, which includes both data folded onboard GRO and 1.024 second resolution discriminator rates folded on the ground, are presented. Author

N92-21897*# Calgary Univ. (Alberta). Dept. of Physics and Astronomy.
THE 144 SECOND PERIODIC FLUX VARIATIONS DURING X RAY TURN-ON OF HERCULES X-1 **c93**
D. A. Leahy, A. Yoshida, N. Kawai, and M. Matsuoka (Institute of Physical and Chemical Research, Saitama, Japan) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 193-200 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Hercules X-1 is a well known bright binary X ray pulsator. It has a 1.70 day orbital period, a pulsation period of 1.24 second, and a 35 day semiperiodic variability. The discovery is reported of a new 144 second periodicity in the X ray emission from Her X-1. The periodicity is seen in X ray observations of Her X-1 by the LAC instrument onboard the Ginga satellite during Aug. to Sep. 1988. The periodic flux variations occur during the time of X ray turnon at the beginning of a high state of Her X-1, in the same time that a pre-eclipse dip also occurs. An analysis of the LAC spectra of Her X-1 during this period is also presented. Large changes in spectral shape occur associated with the dip. Author

N92-21898*# California Univ., San Diego, La Jolla. Center for Astrophysics and Space Sciences.
COMPTON BACKSCATTERED ANNIHILATION LINE EMISSION: A NEW DIAGNOSTIC OF ACCRETING COMPACT SOURCES
Richard E. Lingenfelter and Xin-Min Hua (Institute for Space and Terrestrial Science, Concord, Ontario) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 201-208 Sponsored in part by Province of Ontario for

ISTS (For primary document see N92-21874 12-90)
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Avail: NTIS HC/MF A24 CSCL 03B

It is shown that Compton scattering of 511 keV electron-positron annihilation radiation produces a line like feature at approx. 170 keV from backscattered photons. Assuming a simple model of an accretion disk around a compact source, the spectrum is explored of the spectrum of Compton scattered annihilation line emission for a range of conditions. It is further shown that such Compton baskscattering of annihilation line emission from the inner edge of an accretion disk could account for the previously unidentified 170 keV line emission and high energy continuum observed from a variable, compact source, or sources, of annihilation radiation near the Galactic Center. Identification of the observed 170 keV line as an annihilation line reflection feature provides strong new evidence that the source of the emission is an accreting compact object. Further study of these features in existing spectra and in forthcoming GRO observation of these and other sources can provide unique new diagnostics of the innermost regions of accretion disks around compact objects. Author

N92-21899*# Commissariat a l'Energie Atomique, Saclay (France). Service d'Astrophysique.
DETECTION AND PERIOD MEASUREMENTS OF GX1+4 AT HARD X RAY ENERGIES WITH THE SIGMA TELESCOPE c93
Ph. Laurent, L. Salotti, F. Lebrun, J. Paul, M. Denis, D. Barret, E. Jourdain, J. P. Roques, E. Churazov, and M. Gilfanov (Academy of Sciences, USSR, Moscow) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 209-216 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The galactic Low Mass X ray Binary GX1+4 was detected by the coded aperture hard X ray gamma ray SIGMA telescope during the Feb. to April 1991 observations of the galactic center regions. The source, whose emission varied during the survey of a factor greater than 40 pct., reached a maximum luminosity in the 40 to 140 energy range of 1.03 x 10(exp 37) erg/s (D = 8.5 kpc), thus approaching the emission level of the 1970 to 1980 high state. Two minute flux pulsations were detected on Mar. 22 and on Mar. 31 and Apr. 1. Comparison with the last period measurements shows that the current spin-down phase of GX1+4 is ending. Concerning the proposed association of this source with the galactic center 511 keV annihilation emission, upper limits were derived. Author

N92-21900*# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.
HARD X RAY OBSERVATIONS OF VELA X-1 AND A0535+26 WITH HEXE: DISCOVERY OF CYCLOTRON LINES Abstract Only c93
E. Kendziorra, B. Mony, P. Kretschmar, M. Maisack, R. Staubert, S. Doebereiner, J. Englhauser, W. Pietsch, C. Reppin, and J. Truemper (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 217 Prepared in cooperation with Academy of Sciences (USSR), Moscow (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The X ray pulsars Vela X-1 (4U 0900-40) and A0535+26) were observed with the High Energy X ray Experiment (HEXE) onboard the Mir space station at energies above 20 keV. The pulse profiles of Vela X-1 (P = 283.22 s for JD 244 7486) and A0535+26 (P = 103.27 s for JD 244 7626) were measured up to at least 100 keV. The time averaged pulse profiles of the two sources both show a clear double peak structure with an asymmetric main pulse and a more symmetric secondary pulse. The spectrum of the main pulse is significantly harder than that of the secondary. Pulse phase resolved spectra show absorption features at 54 keV and possibly 27 keV for Vela X-1 and around 100 keV for A0535+26. If these features are interpreted as second and first harmonic (fundamental) cyclotron absorption lines, lower limits are derived of 2.6 x 10(exp 12) and 4.3 x 10(exp 12) Gauss for the magnetic fields of the neutron stars in Vela X-1 and A0535+26, respectively. Author

N92-21901*# Los Alamos National Lab., NM.
GAMMA RAYS FROM THE CRAB AND VELA PULSARS Abstract Only c93
Cheng Ho *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 221 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Gamma ray pulsed emission from the Crab and Vela pulsars are discussed. Emphasis is placed on use of current and future Gamma Ray Observatory observations as diagnostics to examine and constrain theoretical models. Issues on the spectra and pulse profile are discussed. Specifically, the absence and possibly significant time variability of pulsed emission below 10 MeV from the Vela pulsar represents a serious challenge to current astronomical models. Theoretical implication of this 'peculiarity' is addressed. Author

N92-21902*# La Sapienza Univ., Rome (Italy). Ist. Astronomico.
THE CRAB PULSAR LIGHT CURVE IN THE SOFT GAMMA RAY RANGE: FIGARO II RESULTS
E. Massaro, B. Agrinier, E. Barouch, R. Comte, E. Costa, G. C. Cusumano, G. Gerardi, D. Lemoine, P. Mandrou, and J. L. Masnou (Observatoire de Paris-Meudon, France) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 222-228 Prepared in cooperation with Osservatorio Astrofisico di Arcetri, Florence, Italy Sponsored by CNES and ASI (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The FIGARO II experiment (a large area, balloon borne, crystal scintillator detector working from 0.15 to 4.3 MeV) observed the Crab pulsar on 1990 Jul. 9 for about seven hours. The study of the pulse profile confirms some structures detected with a low significance during the shorter observation of 1986, and adds new important elements to the picture. In particular, between the two main peaks, two secondary peaks appear centered at phase values 0.1 and 0.3, in the energy range 0.38 to 0.49 MeV; in the same energy range, a spectral feature at 0.44 MeV, interpreted as a redshifted positron annihilation line, was observed during the same balloon flight in the phase interval including the second main peak and the neighboring secondary peak. If the phase interval considered is extended to include also the other secondary peak, the significance of the spectral line appears to increase. Author

N92-21903*# Lawrence Livermore National Lab., CA. Inst. of Geophysics and Planetary Physics.
GAMMA RAYS FROM HIDDEN MILLISECOND PULSARS c93
Marco Tavani *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 229-236 Prepared in cooperation with California Univ., Berkeley (For primary document see N92-21874 12-90)
(Contract W-7405-eng-48; GRO-90-29; GRO-PFP-91-23)
Avail: NTIS HC/MF A24 CSCL 03B

The properties were studied of a new class of gamma ray sources consisting of millisecond pulsars totally or partially surrounded by evaporating material from irradiated companion stars. Hidden millisecond pulsars offer a unique possibility to study gamma ray, optical and radio emission from vaporizing binaries. The relevance of this class of binaries for GRO observations and interpretation of COS-B data is emphasized. Author

N92-21904*# Stanford Univ., CA. Dept. of Physics.
PULSAR GAMMA RAYS FROM POLAR CAP REGIONS c93
James Chiang and Roger W. Romani *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 237-244 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The production is studied of pulsar gamma rays by energetic electrons flowing in the open field region above pulsar polar caps. The propagation was followed of curvature radiation from primary electrons, as well as hard synchrotron radiation generated by secondary pairs, through the pulsar magnetosphere for vacuum dipole open field geometries. Using data from radio and optical observations, models were constructed for the specific geometries and viewing angles appropriate to particular pulsars. These detailed models produce normalized spectra above 10 MeV, pulse profiles, beaming fractions and phase resolved spectra appropriate for direct comparison with COS-B and GRO data. Models are given for the Crab, Vela, and other potentially detectable pulsars; general agreement with existing data is good, although perturbations to the simplified models are needed for close matches. The calculations were extended to the millisecond pulsar range, which allows the production of predictions for the flux and spectra of populations of recycled pulsars and search strategies are pointed out. Author

N92-21905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

TWO-PHOTON ANNIHILATION OF THERMAL PAIRS IN STRONG MAGNETIC FIELDS

Matthew G. Baring (North Carolina State Univ., Raleigh.) and Alice K. Harding *In its* The Compton Observatory Science Workshop Feb. 1992 p 245-252 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

The annihilation spectrum of pairs with 1-D thermal distributions in the presence of a strong magnetic field is calculated. Numerical analysis of the spectrum are performed for mildly relativistic temperatures and for different angles of emission with respect to field lines. Teragauss magnetic fields are assumed so that conditions are typical of gamma ray burst and pulsar environments. The spectra at each viewing angle reveal asymmetric line profiles that are signatures of the magnetic broadening and red shifting of the line: these asymmetries are more prominent for small viewing angles. Thermal Doppler broadening tends to dominate in the right wing of the line and obscures the magnetic broadening more at high temperatures and smaller viewing angles. This angular dependence of the line asymmetry may prove a valuable diagnostic tool. For low temperatures and magnetic field strengths, useful analytic expressions are presented for the line width, and also for the annihilation spectrum at zero viewing angle. The results presented find application in gamma ray burst and pulsar models, and may prove very helpful in deducing field strengths and temperatures of the emission regions of these objects from line observations made by Compton GRO and future missions.

Author

N92-21906*# Northwestern Univ., Evanston, IL.

OSSE OBSERVATIONS OF THE CRAB PULSAR

M. P. Ulmer, S. M. Matz, R. A. Cameron, D. A. Grabelsky, J. E. Grove, W. N. Johnson, G. V. Jung, R. L. Kinzer, J. D. Kurfess, and M. D. Leising (Clemson Univ., SC.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 253-259 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

Preliminary results are presented of the Compton Gamma Ray Observatory Oriented Scintillation Spectrometer Experiment (OSSE) observations of the Crab pulsar. The pulsar energy spectra and light curves are in general agreement with previous observations, validating the OSSE pulsar data acquisition modes and data analysis algorithms. The data suggest that the spectrum of the pulsar varies throughout the light curve. The 'interpulse' region has a slightly flatter spectrum in the approx. 60 to 250 keV region and a slightly steeper spectrum at higher energies than the two main pulses. No evidence was found for any lines in the spectra with a typical sensitivity of about 10(exp -4) photons/sq cm/s. Author

N92-21907*# Cornell Univ., Ithaca, NY.

CRAB PULSAR GIANT PULSES: SIMULTANEOUS RADIO AND GRO OBSERVATIONS

Scott C. Lundgren, James M. Cordes, Roger Foster, Tim Hankins, Mel Ulmer, and Chris Garasi (Case Western Reserve Univ., Cleveland, OH.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 260-266 Sponsored in part by NSF (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

Observations are reported of the Crab pulsar made at radio frequencies concurrent with Oriented Scintillation Spectrometer Experiment (OSSE) observations from 15 to 27 May 1991. Using the 43 m telescope at Green Bank at 0.8 and 1.4 GHz, samples were made continuously for 10 hrs/day at intervals of 100 to 300 microsecs. The analysis of the radio data includes calculation of histograms of pulse intensities, absolute timing to about 20 microsec precision, and characterization of intensity variations on time scales from the 33 ms spin period to days. The most detailed analysis is presented made of giant pulses. The ultimate goal is to bin the radio data into giant and nongiant pulses and to form average waveforms of OSSE data for the corresponding pulse periods. A test is done to see whether the violet radio fluctuations (which are not seen in other radio pulsars to the same degree) are correlated with low energy gamma rays, yielding constraints on the radio coherence mechanism and the steadiness of the electron-positron outflow in the magnetosphere. Timing analysis of the radio data provides a well defined ephemeris over the specified range of epochs. The gamma ray pulse phase was predicted with an error of less than 70 microsecs. Author

N92-21908*# Clemson Univ., SC. Dept. of Physics and Astronomy.

GAMMA RAY PULSAR ANALYSIS FROM PHOTON PROBABILITY MAPS

Lawrence E. Brown, Donald D. Clayton, and Dieter H. Hartmann *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 267-272 Previously announced as N92-16970 (For primary document see N92-21874 12-90)

(Grant NAG5-1578)

Avail: NTIS HC/MF A24 CSCL 03B

A new method is presented of analyzing skymap-type gamma ray data. Each photon event is replaced by a probability distribution on the sky corresponding to the observing instrument's point spread function. The skymap produced by this process may be used for source detection or identification. Most important, the use of these photon weights for pulsar analysis promises significant improvement over traditional techniques. Author

N92-21909*# Chicago Univ., IL. Dept. of Astronomy and Astrophysics.

ISSUES IN THE ANALYSIS AND INTERPRETATION OF CYCLOTRON LINES IN GAMMA RAY BURSTS **c93**

D. Q. Lamb *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 275-286 (For primary document see N92-21874 12-90)

(Grants NAGw-830; NAGw-1284)

Avail: NTIS HC/MF A24 CSCL 03B

The Bayesian approach is discussed to establishing the existence of lines, the importance of observing multiple cyclotron harmonics in determining physical parameters from the lines, and evidence from cyclotron lines of neutron star rotation. Author

N92-21910*# Princeton Univ. Observatory, NJ.

ON THE GALACTIC ORIGIN OF GAMMA RAY BURSTS
Abstract Only **c93**

Bohdan Paczynski *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 287 (For primary document see N92-21874 12-90)

Avail: NTIS HC/MF A24 CSCL 03B

If gamma ray bursters are in the galactic disk, then the average value of the V/Vmax parameter cannot be lower than 0.4, no matter what is the source luminosity function or what is the disk

thickness. The value of 0.4 is reached only asymptotically when the range of observations is much larger than the disk scale height, and almost all sources are within a very thin galactic equatorial belt. This distribution is in a direct conflict with the BATSE results as presented. If the bursters have a galactic halo distribution similar to that of any other known class of objects, then a strong dipole moment in their angular distribution should be seen, i.e., a strong concentration towards the galactic center. To make the dipole moment unmeasurable, the hypothetical burster's halo must have a core radius of at least 14 kpc (a 3 sigma limit) to be consistent with the BATSE results as presented. Author

N92-21911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ULYSSES/BATSE OBSERVATIONS OF COSMIC GAMMA RAY BURSTS **c93**
K. Hurley, M. Boer, M. Sommer, G. Fishman, C. Meegan, W. Paciesas, R. Wilson, C. Kouveliotou (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.), and T. Cline *In its* The Compton Observatory Science Workshop Feb. 1992 p 288-292 (For primary document see N92-21874 12-90)
(Contract NAG5-1560; JPL-958056)
Avail: NTIS HC/MF A24 CSCL 03B

The gamma ray burst detector aboard the ESA-NASA Ulysses spacecraft, in operation since Nov. 1990, has detected numerous gamma bursts in conjunction with the BATSE experiment aboard the Compton Observatory. Initial results are presented on burst locations for three events (21 April, 2 May, and 3 May, 1991) obtained by arrival time analysis, and they are compared with the BATSE locations. The arrival time analysis annuli have typical widths of 5'. The preliminary analysis indicates that both experiments are likely to have unresolved systematic errors, but that further work will improve the location accuracy substantially.
Author

N92-21912*# North Carolina State Univ., Raleigh. Dept. of Physics.
MAGNETIC PHOTON SPLITTING AND GAMMA RAY BURST SPECTRA **c93**
Matthew G. Baring *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 293-300 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The splitting of photons into two photons becomes both possible and significant in magnetic fields in excess of 10(exp 12) Gauss. Below the threshold energy, 2m sub e c(exp 2) for single photon pair production, splitting can be an astronomically observable phenomenon evident in gamma ray burst spectra. In such circumstances, it was found that magnetic photon splitting reprocesses the gamma ray burst continuum by degrading the photon energy, with a net effect that is quite similar to pair cascade reprocessing of the spectrum. Results are presented for the spectral modifications due to splitting, taking into account the different probabilities for splitting for different polarization modes. Unpolarized and polarized pair cascade photon spectra form the input spectra for the model, which calculates the resulting splitting reprocessed spectra numerically by solving the photon kinetic equations for each polarization mode. This inclusion of photon polarizations is found to not alter previous predictions that splitting produce a significant flattening of the hard X ray continuum and a bump at MeV energies below a pair production turnover. The spectrum near the bump is always strongly polarized. Author

N92-21913*# Space Telescope Science Inst., Baltimore, MD.
GAMMA RAY BURST ASTROMETRY 2: NUMERICAL TESTS **c93**
L. G. Taff and S. T. Holfeltz *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 301-308 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Since the announcement of the discovery of sources of gamma ray radiation in 1973, many more reports of such bursts have been published. Numerous artificial satellites have been equipped with gamma ray detectors including GRO. Unfortunately, almost no progress has been made in identifying the sources of this high energy radiation. Only one visible counterpart is known. It is suspected that this is a consequence of the methods currently used to define gamma ray burst source 'error boxes'. An alternative procedure was proposed in 1988 by Taff. Herein, Monte Carlo simulations are reported of the efficacy of this technique using realistic burst timing uncertainties and satellite location errors as well as a variety of satellite constellations. Since these are controlled numerical experiments, the dependence is examined of the statistics of the errors in the deduced burst wavefront normal as a function of the timing inconsistencies, detector location standard deviations, and especially the number and distribution of the detectors. The results clearly show that an arc minute prediction of a unique burst location is routinely obtainable once there are at least two interplanetary detectors. Author

N92-21914*# Lodz Univ. (Poland). Inst. of Physics.
UNTHERMALIZED POSITRONS IN GAMMA RAY BURST SOURCES **c93**
W. Tkaczyk and S. Karakula *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 309-316 Sponsored in part by Polish Ministry of Education (For primary document see N92-21874 12-90)
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The spectra of the broadening 0.511 MeV annihilation line produced by high temperatures was calculated in the case of unthermalized plasma; i.e., T sub e(+) is not = T sub e(-). The flattening in the spectrum of the annihilation lines for large differences of electron and positron temperatures is a strong indication that the observed features of the hard tailed spectrum of the gamma bursts can be well described by annihilation of unthermalized positrons. It is proposed that the charge separation occurring in Eddington limited accretion onto a neutron star or the one photon pair production in strong magnetic fields as a mechanism for the production of unthermalized positrons in the sources of gamma bursts. From the best fit of experimental spectra by the model, the parameters of sources for which the regions with different plasma temperatures can exist is evaluated.
Author

N92-21915*# Columbia Univ., New York, NY. Astrophysics Lab.
ULTRASOFT X RAY BURSTS: A CLUE TO THE ORIGIN OF GAMMA RAY BURSTS? Abstract Only **c93**
D. J. Helfand, E. Gotthelf, and T. T. Hamilton *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 317 (For primary document see N92-21874 12-90)
(Grant NAG8-183)
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A search was conducted for short timescale (less than or approx. 10 s) faint X ray bursts in the complete 201,000,000 photon Einstein Observatory imaging proportional counter (IPC) data base. Some 73,000,000 events were extracted which were distributed among 11,230 observing intervals with an average observing time of approx. 1400 seconds. To exclude all sources, only those spatial pixels were searched with a count rate less than 6 x 10(exp -4) counts/sec sq arcmin. The mean count rate was much less. All files with less than 400 secs of observing time were excluded. The data was then binned into overlapping cells 4'.3 by 4'.3 by 10 secs in volume, and all the space-time cells were searched to locate cells with more than 5 counts in a 10 sec interval; i.e., a minimum flux enhancement of 50 over the mean rate for that point in space. Some 52 such events were found. An annulus was inspected around the event to see if it coincided with a general rise in the counter's event rate. Ten events did coincide with counter phenomena; these were associated with sunrise, sunset, or the approach of the South Atlantic Anomaly and were excluded. The remaining 42 events were then examined in an attempt to associate them with instrumental or environmental

artifacts. The event occurrence times are uniformly distributed over the course of the mission and show no correlation with local solar time; their positions are randomly distributed in geographic, Galactic, and celestial coordinates. Their summed radial distribution is consistent with the point response function of the IPC for a soft source, indicating that the events are focused by the Observatory's mirror system. The integrated spectrum is, indeed, quite soft and is very similar to that of the cataclysmic variable star U Gem in outburst. Most of the events have risetimes of less than or approx. 1 sec and decay times ranging from 1 to 20 sec. Their positions are not associated with any class of catalogued objects. Several possible origins are discussed for the events; if they are associated with gamma ray bursters, they provide interesting constraints on the space density and repetition rate of the underlying source population. Author

N92-21916*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GAMMA RAY MONITORING OF A AGN AND GALACTIC BLACK HOLE CANDIDATES BY THE COMPTON GAMMA RAY OBSERVATORY **c93**
R. T. Skelton, James C. Ling, William A. Wheaton, Alan Harmon, G. J. Fishman, C. A. Meegan, William S. Paciesas, Duane E. Gruber, Brad Rubin, and R. B. Wilson (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 321-327 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Compton Gamma-Ray Observatory's Burst and Transient Source Experiment (BATSE) has a powerful capability to provide nearly uninterrupted monitoring in the 25 keV-10 MeV range of both active galactic nuclei (AGN) and galactic black hole candidates (GBHC) such as Cygnus X-1, using the occultation of cosmic sources by the Earth. Since the Crab is detected by the BATSE Large Area Detectors with roughly 25(sigma) significance in the 15-125 keV range in a single rise or set, a variation by a factor of two of a source having one-tenth the strength of Cygnus X-1 should be detectable within a day. Methods of modeling the background are discussed which will increase the accuracy, sensitivity, and reliability of the results beyond those obtainable from a linear background fit with a single rise or set discontinuity. Author

N92-21917*# Rice Univ., Houston, TX. Dept. of Space Physics and Astronomy.
GAMMA RAYS FROM EXTRAGALACTIC RADIO SOURCES **c93**
Charles D. Dermer, Reinhard Schlickeiser, and Apostolos Mastichiadis (Max-Planck-Inst. fuer Kernphysik, Heidelberg, Germany, F.R.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 328-334 (For primary document see N92-21874 12-90)
(Grant NAG5-1547)
Avail: NTIS HC/MF A24 CSCL 03B

It is proposed that the important connection between 3C 273 and 3C 279, the first two extragalactic sources detected at greater than 100 MeV energies, is their superluminal nature. In support of this conjecture, we propose a radiation mechanism that focuses gamma rays in the superluminal direction, due to Compton scattering of accretion-disk photons by relativistic nonthermal electrons in the jet. Author

N92-21918*# Michigan Univ., Ann Arbor. Lab. of Physics.
UNIVERSAL ENERGY SPECTRUM FROM POINT SOURCES
Yukio Tomozawa *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 335-338 Sponsored in part by DOE (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The suggestion is made that the energy spectrum from point sources such as galactic black hole candidates (GBHC) and active galactic nuclei (AGN) is universal on the average, irrespective of the species of the emitted particles, photons, nucleons, or others. The similarity between the observed energy spectra of cosmic rays, gamma-rays, and X-rays is discussed. In other words, the existing data for gamma-rays and X-rays seem to support the prediction. The expected data from the Gamma Ray Observatory are to provide a further test. Author

N92-21919*# Boston Univ., MA. Dept. of Astronomy.
EXPECTED LEVEL OF SELF-COMPTON SCATTERING IN RADIO LOUD QUASARS
Steven D. Bloom and Alan P. Marscher *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 339-345 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Radio-loud quasars usually contain parsec-scale nonthermal jets. The most compact emission region ('the core'), and perhaps some of the moving 'knots', are expected to be efficient producers of inverse Compton scattered X-rays and gamma-rays since many of the synchrotron photons will upscatter before escaping. Through multifrequency flux density observations and Very Long Baseline Interferometry (VLBI) measurements of angular sizes, one can predict the flux density of this self-Compton high-energy emission. It is not always the case that the brightest synchrotron sources are also the brightest X-ray and gamma-ray sources. Perhaps a better predictor of high-energy brightness is the ratio of hard X-ray to high-frequency radio emission. Using the synchrotron self-Compton relations, we predict the gamma-ray fluxes of several sources we expect to be detected by the Energetic Gamma Ray Experiment Telescope (EGRET). More accurate predictions will be made when we complete a program of contemporaneous radio-submillimeter and X-ray observations during the course of the EGRET all-sky survey. Author

N92-21920*# Boston Univ., MA. Dept. of Astronomy.
HARD GAMMA RAY EMISSION FROM BLAZARS **c93**
Alan P. Marscher and Steven D. Bloom *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 346-353 (For primary document see N92-21874 12-90)
(Grant NAG5-1566)
Avail: NTIS HC/MF A24 CSCL 03B

The gamma-ray emission expected from compact extragalactic sources of nonthermal radiation is examined. The highly variable objects in this class should produce copious amounts of self-Compton gamma-rays in the compact relativistic jet. This is shown to be a likely interpretation of the hard gamma-ray emission recently detected from the quasar 3C 279 during a period of strong nonthermal flaring at lower frequencies. Ways of discriminating between the self-Compton model and other possible gamma-ray emission mechanisms are discussed. Author

N92-21921*# New Hampshire Univ., Durham. Space Science Center.
GAMMA RAYS FROM CLUSTERS OF GALAXIES Abstract Only **c93**
W. Thomas Vestrand *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 355 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The possibility that Coma-type radio halos are powered by secondary electrons produced during the decay of energetic charge pions is examined. These pions are generated by the collision of cosmic ray protons with thermal ions in the intracluster medium. A calculation of both the cosmic ray concentration and the spectrum needed to power the halo in the Coma cluster is presented. The gamma-ray flux is predicted and it is shown that this model can be tested with the Gamma Ray Observatory Energetic Gamma Ray Experiment Telescope. Author

N92-21922*# George Mason Univ., Fairfax, VA. Dept. of Physics.
GAMMA RAY FLARES IN AGN **c93**

M. Kafatos *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 356-358 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The inner regions of accretion disks of supermassive black holes can become unstable when the existing temperatures are sufficiently high. This naturally occurs for two-temperature disks in the case of rapidly spinning (Kerr) black holes. Physical effects in the hot, inner regions are such that non-steady flows can result. Effects which would be relevant in producing variability in intense gamma-ray sources (MeV to GeV range), such as the recent discovery of strong gamma-ray emission in 3C 279, are discussed. D.R.D.

N92-21923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SPECTRAL-LUMINOSITY EVOLUTION OF ACTIVE GALACTIC NUCLEI AND THE COSMIC X- AND GAMMA RAY BACKGROUND
Darryl Leiter (Army Foreign Science and Technology Center, Charlottesville, VA.) and Elihu Boldt *In its* The Compton Observatory Science Workshop Feb. 1992 p 359-366 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Coherent electromagnetic dynamo acceleration processes, which act on charge particles within the context of black hole accretion disk scenarios, are generally regarded as the underlying central power source for active galactic nuclei (AGN). If the precursor active galaxies (PAG) for such AGN are formed at high redshift and contain initial seed black holes with mass approximately equal to 10(exp 4) solar masses, then the Eddington limited X-ray radiation emitted during their lifetime will undergo the phenomenon of 'spectral-luminosity evolution'. When accretion disks are first formed at the onset of galaxy formation the accretion rate occurs at very high values of luminosity/size compactness parameter L/R greater than 10(exp 30) erg/cm-sec. In the absence of extended structure, such high values of L/R generate dynamic constraints which suppress coherent, black hole/accretion disk dynamo particle acceleration processes. This inhibits nonthermal radiation processes and causes the spectrum of X-radiation emitted by PAG to be predominantly thermal. A superposition of PAG sources at z is greater than or equal to 6 can account for the residual cosmic X-ray background (CXB) obtained from the total CXB after subtraction of foreground AGN sources associated with present epoch Seyfert galaxies. The manner in which the PAG undergo spectral-luminosity evolution into Seyfert galaxies is investigated. Author

N92-21924*# Chicago Univ., IL. Dept. of Astronomy and Astrophysics.
X RAY AND GAMMA RAY EMISSION FROM CLASSICAL NOVA OUTBURSTS **c93**
James W. Truran, Sumner Starrfield, and Warren M. Sparks (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 369-376 Sponsored in part by NASA, NSF, and DOE (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The outbursts of classical novae are now recognized to be consequences of thermonuclear runaways proceeding in accreted hydrogen-rich shells on white dwarfs in close binary systems. For the conditions that are known to exist in these environments, it is expected that soft x-rays can be emitted, and indeed x-rays were detected from a number of novae. The circumstances for which we expect novae to produce significant x-ray fluxes and provide estimates of the luminosities and effective temperatures are described. It is also known that at the high temperatures that are known to be achieved in this explosive hydrogen-burning environment, significant production of both Na-22 and Al-26 will occur. In this context, we identify the conditions for which gamma-ray emission may be expected to result from nova outbursts. Author

N92-21925*# Arizona State Univ., Tempe. Dept. of Physics and Astronomy.
A BURST FROM A THERMONUCLEAR RUNAWAY ON AN ONeMg WHITE DWARF **c93**
S. Starrfield, M. Politano, J. W. Truran, and W. M. Sparks (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 377-386 Sponsored in part by NASA; NSF; and DOE (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Studies which examine the consequences of accretion, at rates of 10(exp -9) solar mass/yr and 10(exp -10) solar mass/yr, onto an ONeMg white dwarf with a mass of 1.35 solar masses are performed. In these studies, a Lagrangian, hydrodynamic, one-dimensional computer code was used. The code now includes a network with 89 nuclei up to Ca-40, elemental diffusion, new opacities, and new equation of state. The initial abundance distribution corresponded to a mixture that was enriched to either 25, 50, or 75 percent in products of carbon burning. The remaining material in each case is assumed to have a solar composition. The evolution of the thermonuclear runaway in the 1.35 solar mass white dwarf, with M = 10(exp -9) solar mass, produced peak temperatures in the shell source exceeding 300 million degrees. The sequence produced significant amounts of Na-22 from proton captures onto Ne-20 and significant amounts of Al-26 from proton captures on Mg-24. This sequence ejected 5.2 x 10(exp -6) solar mass moving with speeds from approximately 100 km/s to 2300 km/s. When the mass accretion rate was decreased to 10(exp -10) solar mass, the resulting thermonuclear runaway produced a shock that moved through the outer envelope of the white dwarf and raised the surface luminosity to L greater than 10(exp 7) solar luminosity and the effective temperature to values exceeding 10(exp 7) K. The interaction of the material expanding from off of the white dwarf with the accretion disk should produce a burst of gamma-rays. Author

N92-21926*# Arizona Univ., Tucson.
SUPERNOVAE AS SOURCES OF GAMMA RAYS Abstract Only **c93**
Adam Burrows *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 387 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Most supernovae are profoundly radioactive and the Gamma Ray Observatory is an ideal instrument for detecting their unique gamma ray line and X-ray signatures. How the observation of these hard photons can be used to do supernova science will be addressed, with particular emphasis being placed on Type Ia explosions and nearby events. Author

N92-21927*# Clemson Univ., SC. Dept. of Physics and Astronomy.
GAMMA RAY CONSTRAINTS ON THE GALACTIC SUPERNOVA RATE
D. Hartmann, L.-S. The, D. D. Clayton, M. Leising, G. Mathews, and S. E. Woosley (Lick Observatory, Santa Cruz, CA.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 388-396 Previously announced as N92-16969 (For primary document see N92-21874 12-90)
(Contract NAG5-1578; NAGw-2525; W-7405-eng-48; NSF 88-13649; NSF 91-15367; SF-ENG-48)
Avail: NTIS HC/MF A24 CSCL 03B

Monte Carlo simulations of the expected gamma-ray signatures of galactic supernovae of all types are performed in order to estimate the significance of the lack of a gamma-ray signal due to supernovae occurring during the last millenium. Using recent estimates of nuclear yields, we determine galactic supernova rates consistent with the historic supernova record and the gamma-ray limits. Another objective of these calculations of galactic supernova histories is their application to surveys of diffuse galactic gamma-ray line emission. Author

N92-21928*# Michigan Univ., Ann Arbor. Lab. of Physics.
LOCATING VERY HIGH ENERGY GAMMA RAY SOURCES WITH ARC MINUTE ACCURACY **c93**
C. W. Akerlof, M. F. Cawley, M. Chantell, D. J. Fegan, K. Harris, A. M. Hillas, D. G. Jennings, R. C. Lamb, M. A. Lawrence, and M. J. Lang (University Coll., Dublin, Ireland) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 399-405 Previously announced in IAA as A91-48489 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The angular accuracy of gamma-ray detectors is intrinsically limited by the physical processes involved in photon detection. Although a number of point-like sources were detected by the COS-B satellite, only two were unambiguously identified by time signature with counterparts at longer wavelengths. By taking advantage of the extended longitudinal structure of Very High Energy gamma-ray showers, measurements in the TeV energy range can pinpoint source coordinates to arc minute accuracy. This was demonstrated using Cerenkov air shower imaging techniques. With two telescopes in coincidence, the individual event circular probable error will be 0.13 deg. The half-cone angle of the field of view is effectively 1 deg. Author

N92-21929*# Michigan Univ., Ann Arbor.
STATUS OF THE WHIPPLE OBSERVATORY CERENKOV AIR SHOWER IMAGING TELESCOPE ARRAY **c89**
C. W. Akerlof, M. F. Cawley, D. J. Fegan, S. Fennell, S. Freeman, D. Frishman, K. Harris, A. M. Hillas, D. Jennings, and R. C. Lamb (Iowa State Univ. of Science and Technology, Ames.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 406-411 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03A

Recently the power of the Cerenkov imaging technique in Very High Energy gamma-ray astronomy was demonstrated by the detection of the Crab nebula at high statistical significance. In order to further develop this technique to allow the detection of weaker or more distant sources a second 10 m class reflector was constructed about 120 m from the original instrument. The addition of the second reflector will allow both a reduction in the energy threshold and an improvement in the rejection of the hadronic background. The design and construction of the second reflector, Gamma Ray Astrophysics New Imaging TElescope (GRANITE) is described. D.R.D.

N92-21930*# Argonne National Lab., IL.
UNDERGROUND MUONS FROM THE DIRECTION OF CYGNUS X-3 **c93**
M. L. Marshak *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 412-413 Prepared in cooperation with Minnesota Univ., Minneapolis; Oxford Univ. (England); Rutherford Appleton Lab.; and Tufts Univ Sponsored in part by DOE and UK Science and Engineering Research Council (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The flux of underground muons from the direction of the binary Cygnus X-3 was measured by the Soudan 2 proton decay detector. This time-projection calorimeter is located at a depth of 2200 m (water equivalent) in northern Minnesota at latitude 48 deg N, longitude 92 deg W. An analysis was then performed that compared both the total observed flux and the observed flux per transit with the number of events expected in the absence of a source. This expected number of events was determined by combining the detector acceptance as a function of time with detector acceptance as a function of the local spatial coordinates. These functions were evaluated by use of off-source events. The direction of Cygnus X-3 was defined as a 2 deg half-angle cone, centered on the nominal source coordinates. This definition is consistent with the expected appearance of a point source in the Soudan 2 detector after consideration of track reconstruction errors, multiple scattering in the rock, and possible systematic effects. Details of the analysis and the results are presented. D.R.D.

N92-21931*# Space Telescope Science Inst., Baltimore, MD.
A NEW CLASS OF GALACTIC DISCRETE GAMMA RAY SOURCES: CHAOTIC WINDS OF MASSIVE STARS
Wan Chen and Richard L. White (Johns Hopkins Univ., Baltimore, MD.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 417-423 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We propose a new class of galactic discrete gamma-ray sources, the chaotic, high mass-loss-rate winds from luminous early-type stars. Early-type stellar winds are highly unstable due to intrinsic line-driven instabilities, and so are permeated by numerous strong shocks. These shocks can accelerate a small fraction of thermal electrons and ions to relativistic energies via the first-order Fermi mechanism. A power-law-like photon spectrum extending from keV to above 10 MeV energies is produced by inverse Compton scattering of the extremely abundant stellar UV photons by the relativistic electrons. In addition, a typical pi(sup 0)-decay gamma-ray spectrum is generated by proton-ion interactions in the densest part of the winds. Author

N92-21932*# Space Telescope Science Inst., Baltimore, MD.
LOW ENERGY GAMMA RAY EMISSION FROM THE CYGNUS OB2 ASSOCIATION **c93**
Wan Chen and Richard L. White (Johns Hopkins Univ., Baltimore, MD.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 424-428 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

According to our newly developed model of gamma-ray emission from chaotic early-type stellar winds, we predict the combined gamma-ray flux from the circumstellar winds of many very luminous early-type stars in the Cyg OB2 association can be detectable by the Energetic Gamma Ray Experiment Telescope (EGRET) (and maybe also by OSSE) on CGRO. Due to different radiation mechanisms, the gamma-ray spectrum from stellar winds can be quite different from that of CYG X-3; this spectral difference and the time-variation of Cyg X-3 flux will help to distinguish the gamma-ray components from different sources in this small region, which is spatially unresolvable by CGRO. Author

N92-21933*# Northwestern Univ., Evanston, IL.
OSSE OBSERVATIONS OF GALACTIC 511 keV ANNIHILATION RADIATION
W. R. Purcell, D. A. Grabelsky, W. N. Johnson, G. V. Jung, R. L. Kinzer, J. D. Kurfess, M. S. Strickman (Naval Research Lab., Washington, DC.), and M. P. Ulmer *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 431-437 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Oriented Scintillation Spectrometer Experiment (OSSE) on the Compton Gamma-Ray Observatory has performed several observations of the galactic plane and galactic center region to measure the distribution of galactic 511 keV positron annihilation radiation. Preliminary analysis of data collected during the observation of the galactic center region over the period 13-24 Jun. 1991, indicates the presence of a 511 keV line and positronium continuum superimposed on a power-law continuum. The line of flux was found to be (2.7 +/- 0.5) x 10(exp -4) gamma/sq cm sec, with a positronium fraction of (0.9 +/- 0.2). The 3(sigma) upper limit to daily variations in the 511 keV line flux from the mean during the observation interval is 3 x 10(exp -4) gamma/sq cm sec. If all of the observed annihilation radiation is assumed to originate from the x-ray source 1E 1740.7-2942, the corresponding 511 keV line flux would be (3.0 +/- 0.6) x 10(exp -4) gamma/sq cm sec. The 3(sigma) upper limit for 511 keV line emission from the x-ray binary GX1+4 is 6 x 10(exp -4) gamma/sq cm sec. Results from the galactic plane observations at galactic longitudes of 25 degrees (16-21 Aug. 1991) and 339 degrees (6-11 Sep.

1991) suggest that the emission is concentrated near the galactic center. The observations and the preliminary results are described. Author

N92-21934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GRIS OBSERVATIONS OF THE GALACTIC CENTER AND THE GAMMA RAY GALACTIC DIFFUSE CONTINUUM c93
J. Tueller, S. Barthelmy, N. Gehrels, B. J. Teegarden, M. Leventhal, and C. J. MacCallum (New Mexico Univ., Albuquerque.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 438-445 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

On two flights in 1988, the Gamma-Ray Imaging Spectrometer (GRIS) discovered the galactic center in a high state (greater than 1 x 10(exp -3) ph/(sq cm sec)) of positron annihilation line emission (511 keV) after nearly a decade of failed attempts to confirm the exciting early results of balloon and satellite instruments. These two flights represented the first flights of a new generation of high resolution germanium spectrometers designed to achieve significantly greater sensitivity for astrophysical observations. During the fall flight, an observation of the galactic plane at 335 degrees longitude was also performed. This observation showed a very low level of 511 keV emission (2 +/- 1 x 10(exp -4) ph/(sq cm sec)), confirming the galactic center origin of the line, and a high level of hard x-ray and gamma-ray continuum emission (1 x 10(exp -4) ph/(sq cm sec keV) at 100 keV), which we attribute to galactic diffuse emission. Improved fits to the spectrum of the galactic center are presented with the proposed diffuse component subtracted. We conclude that our galactic center continuum spectrum is consistent with the sum of the 1E1740.7-2942 spectrum observed by SIGMA/GRANAT and our 1 = 335 degree galactic plane spectrum. The predicted diffuse flux should be easily measurable by the Oriented Scintillation Spectrometer Experiment (OSSE) experiment on the Gamma Ray Observatory (GRO). Author

N92-21935*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE GAMMA RAY CONTINUUM SPECTRUM FROM THE GALACTIC CENTER DISK AND POINT SOURCES c93
Neil Gehrels and Jack Tueller *In its* The Compton Observatory Science Workshop Feb. 1992 p 446-454 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

A light curve of gamma-ray continuum emission from point sources in the galactic center region is generated from balloon and satellite observations made over the past 25 years. The emphasis is on the wide field-of-view instruments which measure the combined flux from all sources within approximately 20 degrees of the center. These data have not been previously used for point-source analyses because of the unknown contribution from diffuse disk emission. In this study, the galactic disk component is estimated from observations made by the Gamma Ray Imaging Spectrometer (GRIS) instrument in Oct. 1988. Surprisingly, there are several times during the past 25 years when all gamma-ray sources (at 100 keV) within about 20 degrees of the galactic center are turned off or are in low emission states. This implies that the sources are all variable and few in number. The continuum gamma-ray emission below approximately 150 keV from the black hole candidate 1E1740.7-2942 is seen to turn off in May 1989 on a time scale of less than two weeks, significantly shorter than ever seen before. With the continuum below 150 keV turned off, the spectral shape derived from the HEXAGONE observation on 22 May 1989 is very peculiar with a peak near 200 keV. This source was probably in its normal state for more than half of all observations since the mid-1960's. There are only two observations (in 1977 and 1979) for which the sum flux from the point sources in the region significantly exceeds that from 1E1740.7-2942 in its normal state. Author

N92-21936*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
BATSE FLARE OBSERVATIONS IN SOLAR CYCLE 22 c92
R. A. Schwartz, B. R. Dennis, G. J. Fishman, C. A. Meegan, R. B. Wilson, and W. S. Paciesas (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 457-468 Prepared in cooperation with ST Systems Corp., Lanham, MD; and Alabama Univ., Huntsville (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Hard X-Ray Burst Spectrometer (HXRBS) group at GSFC has developed and is maintaining a quick-look analysis system for solar flare hard x-ray data from the Burst and Transient Source Experiment (BATSE) on the recently launched Compton Gamma-Ray Observatory (GRO). The instrument consists, in part, of 8 large planar detectors, each 2025 sq cm, placed on the corners of the GRO spacecraft with the orientation of the faces being those of a regular octahedron. Although optimized for the detection of gamma-ray bursts, these detectors are far more sensitive than any previous spacecraft-borne hard x-ray flare instrumentation both for the detection of small microflares and the resolution of fine temporal structures. The data in this BATSE solar data base are from the discriminator large area (DISCLA) rates. From each of eight detectors there are hard x-ray data in four energy channels, 25-50, 50-100, 100-300, and greater than 300 keV with a time resolution of 1.024 seconds. These data are suitable for temporal correlation with data at other wavelengths, and they provide a first look into the BATSE and other GRO instrument flare data sets. The BATSE and other GRO principle investigator groups should be contacted for the availability of data sets at higher time or spectral resolution or at higher energies. K.S.

N92-21937*# Naval Research Lab., Washington, DC.
GRO SOLAR FLARE OBSERVATIONS Abstract Only c92
R. J. Murphy *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 469 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Although the Gamma Ray Observatory (GRO) instruments are not dedicated to solar observing, their capabilities are such that they can extend and expand the solar hard x ray and gamma ray observations accomplished by instruments such as those of SMM and Hinotori. These capabilities are discussed, with emphasis on the use of the instruments by guest investigators. Instrumental problems associated with observations of large flares are also discussed. The various issues are illustrated with data obtained during the recent period of extraordinary activity on the Sun. Author

N92-21938*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
COMPTEL SOLAR FLARE OBSERVATIONS c92
J. M. Ryan, H. Aarts, K. Bennett, H. Debrunner, C. deVries, J. W. denHerder, G. Eymann, D. J. Forrest, R. Diehl, and W. Hermsen (Leiden Univ., Netherlands) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 470-479 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

COMPTEL as part of a solar target of opportunity campaign observed the sun during the period of high solar activity from 7-15 Jun. 1991. Major flares were observed on 9 and 11 Jun. Although both flares were large GOES events (greater than or = X10), they were not extraordinary in terms of gamma-ray emission. Only the decay phase of the 15 Jun. flare was observed by COMPTEL. We report the preliminary analysis of data from these flares, including the first spectroscopic measurement of solar flare neutrons. The deuterium formation line at 2.223 MeV was present in both events and for at least the 9 Jun. event, was comparable to the flux in the nuclear line region of 4-8 MeV, consistent with Solar-Maximum Mission (SSM) Observations. A clear neutron signal

was present in the flare of 9 Jun. with the spectrum extending up to 80 MeV and consistent in time with the emission of gamma-rays, confirming the utility of COMPTEL in measuring the solar neutron flux at low energies. The neutron flux below 100 MeV appears to be lower than that of the 3 Jun. 1982 flare by more than an order of magnitude. The neutron signal of the 11 Jun. event is under study. Severe dead time effects resulting from the intense thermal x-rays require significant corrections to the measured flux which increase the magnitude of the associated systematic uncertainties. Author

N92-21939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
NEUTRON AND GAMMA RAY PRODUCTION IN THE 1991 JUNE X-CLASS FLARES c92
R. Ramaty, X. M. Hua, B. Kozlovsky, R. E. Lingenfelter, and N. Mandzhavidze (Academy of Sciences of the Georgian SSR, Tbilisi.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 480-485 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We present new calculations of pion radiation and neutron emission from solar flares. We fit the recently reported high energy GAMMA-1 observations with pion radiation produced in a solar flare magnetic loop. We calculate the expected neutron emission in such a loop model and make predictions of the neutron fluences expected from the 1991 June X-class flares. Author

N92-21940*# California Univ., Berkeley. Space Sciences Lab.
STEREOSCOPIC OBSERVATIONS OF HARD X RAY SOURCES IN SOLAR FLARES MADE WITH GRO AND OTHER SPACECRAFT c92
S. R. Kane, K. Hurley, J. M. McTiernan, and J. G. Laros (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 486-488 (For primary document see N92-21874 12-90)
(Contract NAG5-1559; JPL-958056)
Avail: NTIS HC/MF A24 CSCL 03B

Since the launch of the Gamma Ray Observatory (GRO) in Apr. 1991, the Burst and Transient Source Experiment (BATSE) instrument on GRO has recorded a large number of solar flares. Some of these flares have also been observed by the Gamma-Ray Burst Detector on the Pioneer Venus Orbiter (PVO) and/or by the Solar X-Ray/Cosmic Gamma-Ray Burst Experiment on the Ulysses spacecraft. A preliminary list of common flares observed during the period May-Jun. 1991 is presented and the possible joint studies are indicated. Author

N92-21941*# Colorado Univ., Boulder.
COORDINATED SOLAR OBSERVATIONS OBTAINED DURING THE GRO/MAX 1991 TARGET-OF-OPPORTUNITY CAMPAIGN OF JUNE 1991 Abstract Only c92
Alan L. Kiplinger *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 489 Prepared in cooperation with National Oceanic and Atmospheric Administration, Boulder, CO (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

Max 1991 is a program designed to facilitate coordinated observations of solar activity. The program provides and infrastructure for supporting coordinated observations during observing 'campaigns' through various means of electronic communications combined with the ability to monitor real-time solar conditions at NOAA's Space Environment Laboratory. Prior to the extreme solar activity exhibited by active region 6659 combined with the repointing of the Gamma Ray Observatory (GRO) provided Max 1991 with its first opportunity to call an unscheduled campaign and the world community responded with a surprising degree of observational support. Some of the activity and some of the types of observations that were collected simultaneously with the GRO complement of instruments. Author

N92-21942*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MAGNETIC FIELD CONFIGURATION ASSOCIATED WITH SOLAR GAMMA RAY FLARES IN JUNE, 1991 c92
M. J. Hagyard, E. A. West, J. E. Smith, F.-M. Trussart, and E. G. Kenney (Boeing Co., Huntsville, AL.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 490-501 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The vector magnetic field configuration of the solar active region AR 6659 that produced very high levels of flare activity in Jun. 1991 is described. The morphology and evolution of the photospheric fields are described for the period 7-10 Jun., and the flares taking place around these dates and their locations relative to the photospheric fields are indicated. By comparing the observed vector field with the potential field calculated from the observed line-of-sight flux, we identify the nonpotential characteristics of the fields along the magnetic neutral lines where the flares were observed. These results are compared with those from the earlier study of gamma-ray flares. Author

N92-21943*# Maryland Univ., College Park. Dept. of Astronomy.
MILLIMETER AND HARD X RAY/GAMMA RAY OBSERVATIONS OF SOLAR FLARES DURING THE JUNE 1991 GRO CAMPAIGN c92
M. R. Kundu, S. M. White, N. Gopalswamy, and J. Lim *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 502-513 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We have carried out high-spatial-resolution millimeter observations of solar flares using the Berkeley-Illinois-Maryland Array (BIMA). At the present time, BIMA consists of only three elements, which is not adequate for mapping highly variable solar phenomena, but is excellent for studies of the temporal structure of flares at millimeter wavelengths at several different spatial scales. We present BIMA observations made during the Gamma Ray Observatories (GRO)/Solar Max 1991 campaign in Jun. 1991 when solar activity was unusually high. Our observations covered the period 8-9 Jun. 1991; this period overlapped the period 4-15 Jun. when the Compton Telescope made the Sun a target of opportunity because of the high level of solar activity. Author

N92-21944*# California Inst. of Tech., Pasadena. Solar Astronomy 264-33.
RADIO SYNTHESIS IMAGING DURING THE GRO SOLAR CAMPAIGN Abstract Only c92
Dale E. Gary *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 514 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Owens Valley (OVRO) Solar Array was recently expanded to 5 antennas. Using frequency synthesis, the 5-element OVRO Solar Array has up to 450 effective baselines, which can be employed as necessary to make maps at frequencies in the range 1 to 18 GHz. Fortuitously, the last of the 5 antennas was completed and brought into operation on 7 Jun., just in time for the Gamma Ray Observatory (GRO)/Max 1991 observing campaign. Many events were observed jointly with OVRO and the BATSE experiment on GRO, including the six larger events that are presented in tabular form. Unfortunately, the X flares that occurred during the campaign all occurred outside the OVRO time range. The UV coverage of the newly expanded solar array, combined with frequency synthesis, should give a more complete view of solar flares in the microwave range by providing simultaneous spatial and spectral resolution. A promising application of MEM (maximum entropy) is also being pursued that will use smoothness criteria in both the spatial and spectral domains to give brightness temperature maps at each observed frequency (up to 45 frequencies every 10 s). Such maps can be compared directly with the theory of microwave emission to yield plasma parameters

in the source - notably the number and energy distribution of electrons, for comparison with the x ray and gamma ray results from GRO. Author

N92-21945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
VLA, PHOENIX, AND BATSE OBSERVATIONS OF AN X1 FLARE c92
Robert F. Willson, Markus J. Aschwanden, and Arnold O. Benz (Eidgenoessische Technische Hochschule, Zurich, Switzerland) *In its* The Compton Observatory Science Workshop Feb. 1992 p 515-521 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We present observations of an X1 flare (18 Jul. 1991) detected simultaneously with the Very Large Array (VLA), the PHOENIX Digital Radio Spectrometer and the Burst and Transient Source Experiment (BATSE) aboard the Gamma Ray Observatory (GRO). The VLA was used to produce snapshot maps of the impulsive acceleration in the higher corona several minutes before the onset of the hard x ray burst detected by BATSE. Comparisons with high spectral and temporal observations by PHOENIX reveal a variety of radio bursts at 20 cm, such as type 3 bursts, intermediate drift bursts, and quasi-periodic pulsations during different stages of the X1 flare. From the drift rates of these radio bursts we derive information on local density scale heights, the speed of radio exciters, and the local magnetic field. Radio emission at 90 cm shows a type 4 burst moving outward with a constant velocity of 240 km/s. The described X1 flare is unique in the sense that it appeared at the east limb (N06/E88), providing the most accurate information on the vertical structure of different flare tracers visible in radio wavelengths. Author

N92-21946*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GAMMA RAY AND MICROWAVE EMISSION FROM 1991 JUNE EVENTS Abstract Only c92
Shinzo Enome, Hiroshi Nakajima, Hugh S. Hudson (California Univ., San Diego.), and Richard Schwartz *In its* The Compton Observatory Science Workshop Feb. 1992 p 522 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

The Sun showed unprecedented microwave activities in Jun. 1991, which produced four major and numerous weaker bursts and gamma ray emission measured by the Gamma Ray Observatory. The 4 Jun. 1991 event shows a sharp maximum around 03:41 UT and weak emission a few minutes before the maximum in the gamma ray record of the Burst and Transient Source Experiment (BATSE), with a preliminary estimated energy of 5 MeV. Although the 80-GHz and possible 35-GHz records show more prominent emission in the pre-maximum stage. This strongly suggests the first observational evidence for gamma ray and mm-wave emission from relativistic electrons. Comparisons of the other three major events on 6 Jun. at 01:00 UT, 9 Jun. at 01:34 UT, and 11 Jun. at 01:51 UT between gamma ray and microwave emission are also in progress. Author

N92-21947*# Glasgow Univ. (Scotland). Dept. of Physics and Astronomy.
FLARE GAMMA RAY CONTINUUM EMISSION FROM NEUTRAL PION DECAY c92
David Alexander and Alec L. MacKinnon *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 523-527 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We investigate, in detail, the production of solar flare gamma ray emission above 100 MeV via the interaction of high energy protons with the ambient solar atmosphere. We restrict our considerations to the broadband gamma ray spectrum resulting from the decay of neutral pions produced in p-H reactions. Thick-target calculations are performed to determine the photon fluences. However, proton transport is not considered. Inferences about the form of the proton spectrum at 10-100 MeV have already been drawn from de-excitation gamma ray lines. Our aim is to constrain the proton spectrum at higher energies. Thus, the injected proton spectrum is assumed to have the form of a Bessel Function, characteristics of stochastic energy at higher energies. The detailed shape of the gamma ray spectra around 100 MeV is found to have a strong dependence on the spectral index of the power law and on the turnover energy (from Bessel function to power law). As would be expected, the harder the photon spectrum the wider the 100 MeV feature. The photon spectra are to be compared with observations and used to place limits upon the number of particles accelerated and to constrain acceleration models. Author

N92-21948*# Toyama Univ. (Japan). Lab. for Plasma Astrophysics and Fusion Science.
PROMPT PARTICLE ACCELERATION AROUND MOVING X-POINT MAGNETIC FIELD DURING IMPULSIVE PHASE OF SOLAR FLARES c92
Jun-Ichi Sakai *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 528-535 Sponsored in part by ELCO Company (For primary document see N92-21874 12-90)
(Grant ASR-ME-03640247)
Avail: NTIS HC/MF A24 CSCL 03B

We present a model for high-energy solar flares to explain prompt proton and electron acceleration, which occurs around moving X-point magnetic field during the implosion phase of the current sheet. We derive the electromagnetic fields during the strong implosion phase of the current sheets, which is driven by the converging flow derived from the magnetohydrodynamic equations. It is shown that both protons and electrons can be promptly (within 1 second) accelerated to approximately 70 MeV and approximately 200 MeV, respectively. This acceleration mechanism can be applicable for the impulsive phase of the gradual gamma ray and proton flares (gradual GR/P flare), which have been called two-ribbon flares. Author

N92-21949*# Hawaii Univ., Honolulu. Inst. for Astronomy.
SEARCH FOR EVIDENCE OF LOW ENERGY PROTONS IN SOLAR FLARES c92
Thomas R. Metcalf, Jean-Pierre Wuelser, Richard C. Canfield, and Hugh S. Hudson *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 536-541 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

We searched for linear polarization in the H alpha line using the Stokes Polarimeter at Mees Solar Observatory and present observations of a flare from NOAA active region 6659 which began at 01:30 UT on 14 Jun. 1991. Our dataset also includes H alpha spectra from the Mees charge coupled device (MCCD) imaging spectrograph as well as hard x ray observations from the Burst and Transient Source Experiment (BATSE) instrument on board the Gamma Ray Observatory (GRO). The polarimeter scanned a 40 x 40 inch field of view using 16 raster points in a 4 x 4 grid. Each scan took about 30 seconds with 2 seconds at each raster point. The polarimeter stopped 8.5 inches between raster points and each point covered a 6 inch region. This sparse sampling increased the total field of view without reducing the temporal cadence. At each raster point, an H alpha spectrum with 20 mA spectral sampling is obtained covering 2.6 A centered on H alpha line center. The preliminary conclusions from the research are presented. Author

N92-21950*# Delaware Univ., Newark.
COSMIC RAY ALBEDO GAMMA RAYS FROM THE QUIET SUN c92
D. Seckel, T. Stanev, and T. K. Gaisser *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 542-549 (For primary document see N92-21874 12-90)
(Grants NAGw-1644; NAGw-2076)
Avail: NTIS HC/MF A24 CSCL 03B

We estimate the flux of gamma-rays that result from collisions

of high energy galactic cosmic rays with the solar atmosphere. An important aspect of our model is the propagation of cosmic rays through the magnetic fields of the inner solar systems. We use diffusion to model propagation down to the bottom of the corona. Below the corona we trace particle orbits through the photospheric fields to determine the location of cosmic ray interactions in the solar atmosphere and evolve the resultant cascades. For our nominal choice of parameters, we predict an integrated flux of gamma rays (at 1 AU) of F(E(sub gamma) greater than 100 MeV) approximately = 5 x 10(exp -8)/sq cm sec. This can be an order of magnitude above the galactic background and should be observable by the Energetic Gamma Ray experiment telescope (EGRET). Author

N92-21981*# Johns Hopkins Univ., Baltimore, MD. Dept. of Physics and Astronomy.
DUST NEAR LUMINOUS ULTRAVIOLET STARS Progress Report
Richard C. Henry Mar. 1992 41 p
(Grant NAG5-1282)
(NASA-CR-190144; NAS 1.26:190144) Avail: NTIS HC/MF A03 CSCL 03B

More than 700 luminous stars in the infrared astronomical satellite (IRAS) Skyflux plates were examined for the presence of dust heated by a nearby star. This dust may be distinguished from the ubiquitous cool cirrus by its higher temperature and thus enhanced 60 micron emission. More than 120 dust clouds were found around only 106 of the stars with a volume filling factor of 0.006 and an intercloud separation of 46 pc. A region of dust smoothly distributed through the volume of space heated by the star could not be found and hence an upper limit of 0.05 cm(exp -3) is placed on the equivalent gas density in the intercloud regions. The clouds have an average density of 0.22 cm(exp -3) and a radius of 1.9 pc, albeit with wide variations in their properties. Two different scale heights of 140 and 540 pc were found. This was interpreted as evidence for different distributions of dust in and out of the galactic disk. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

No abstracts in this category.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

N92-21081# Los Alamos National Lab., NM.
THE ULYSSES SOLAR WIND PLASMA INVESTIGATION: DESCRIPTION AND INITIAL IN-ECLIPTIC RESULTS
S. J. Bame, J. L. Phillips, D. J. McComas, J. T. Gosling, and B. E. Goldstein 1991 5 p Presented at the 7th Solar Wind Conference, Goslar (Germany), 16-21 Sep. 1991
(Contract W-7405-eng-36)
(DE92-007715; LA-UR-92-77; CONF-910915-6) Avail: NTIS HC/MF A01

During the in-ecliptic flight of Ulysses from the Earth toward its encounter with Jupiter, the Los Alamos solar wind plasma experiment has performed well. Briefly described, the instrumentation contains two independent electrostatic analyzers, one for ions and one for electrons. Initial analysis of solar wind electron core temperatures obtained between 1.15 and 3.76 AU yields a gradient of T (proportional to) R(exp -0.7) which is flatter than expected for adiabatic expansion of a single-temperature Maxwellian velocity distribution and steeper than that obtained from Mariner-Voyager. DOE

N92-21298 California Univ., Berkeley.
ROTATION OF THE OUTER LAYER OF THE SUN Ph.D. Thesis
Samir Bouaoudia 1990 125 p
Avail: Univ. Microfilms Order No. DA9126485

The problem of differential rotation in the radiative regions of slowly rotating main-sequence stars is addressed. Inhomogeneous compositions and magnetic fields are ignored. Although this is a classical problem is astrophysics, several fundamental questions regarding the basic magnitude and structure of the flow remain unanswered. Von Zeipel pioneered the study of this problem by showing that solid-body rotation is not possible in radiatively stable zones. The goal is to find alternatives to pure sold-body rotation. A numerical approach was tried, but found to be too ill-conditioned to give accurate results. However, in setting up the equations for numerical solutions, we solved the long-standing computational problem of how to compute efficiently high-order solutions at a coordinate singularity. The classical derivation of the von Zeipel paradox is derived analytically to be incorrect for slowly rotating stars and a new proof is shown. This new derivation shows that solid-body rotation is allowed if certain conditions are fulfilled, and that those conditions are approximately fulfilled in the outer regions of the radiative zones of solar-like stars. A first-order perturbation is used to compute the differential rotation. Dissert. Abstr.

N92-21936*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
BATSE FLARE OBSERVATIONS IN SOLAR CYCLE 22
R. A. Schwartz, B. R. Dennis, G. J. Fishman, C. A. Meegan, R. B. Wilson, and W. S. Paciesas (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 457-468 Prepared in cooperation with ST Systems Corp., Lanham, MD; and Alabama Univ., Huntsville (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21937*# Naval Research Lab., Washington, DC.
GRO SOLAR FLARE OBSERVATIONS Abstract Only
R. J. Murphy *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 469 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21938*# Max-Planck-Inst. fuer Extraterrestrische Physik, Garching (Germany, F.R.).
COMPTEL SOLAR FLARE OBSERVATIONS
J. M. Ryan, H. Aarts, K. Bennett, H. Debrunner, C. deVries, J. W. denHerder, G. Eymann, D. J. Forrest, R. Diehl, and W. Hermsen (Leiden Univ., Netherlands) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 470-479 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
NEUTRON AND GAMMA RAY PRODUCTION IN THE 1991 JUNE X-CLASS FLARES
R. Ramaty, X. M. Hua, B. Kozlovsky, R. E. Lingenfelter, and N. Mandzhavidze (Academy of Sciences of the Georgian SSR, Tbilisi.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 480-485 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21940*# California Univ., Berkeley. Space Sciences Lab.
STEREOSCOPIC OBSERVATIONS OF HARD X RAY SOURCES IN SOLAR FLARES MADE WITH GRO AND OTHER SPACECRAFT

S. R. Kane, K. Hurley, J. M. McTiernan, and J. G. Laros (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 486-488 (For primary document see N92-21874 12-90)
(Contract NAG5-1559; JPL-958056)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21941*# Colorado Univ., Boulder.
COORDINATED SOLAR OBSERVATIONS OBTAINED DURING THE GRO/MAX 1991 TARGET-OF-OPPORTUNITY CAMPAIGN OF JUNE 1991 Abstract Only
Alan L. Kiplinger *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 489 Prepared in cooperation with National Oceanic and Atmospheric Administration, Boulder, CO (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21942*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MAGNETIC FIELD CONFIGURATION ASSOCIATED WITH SOLAR GAMMA RAY FLARES IN JUNE, 1991
M. J. Hagyard, E. A. West, J. E. Smith, F.-M. Trussart, and E. G. Kenney (Boeing Co., Huntsville, AL.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 490-501 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21943*# Maryland Univ., College Park. Dept. of Astronomy.
MILLIMETER AND HARD X RAY/GAMMA RAY OBSERVATIONS OF SOLAR FLARES DURING THE JUNE 1991 GRO CAMPAIGN
M. R. Kundu, S. M. White, N. Gopalswamy, and J. Lim *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 502-513 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21944*# California Inst. of Tech., Pasadena. Solar Astronomy 264-33.
RADIO SYNTHESIS IMAGING DURING THE GRO SOLAR CAMPAIGN Abstract Only
Dale E. Gary *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 514 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
VLA, PHOENIX, AND BATSE OBSERVATIONS OF AN X1 FLARE
Robert F. Willson, Markus J. Aschwanden, and Arnold O. Benz (Eidgenoessische Technische Hochschule, Zurich, Switzerland) *In its* The Compton Observatory Science Workshop Feb. 1992 p 515-521 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21946*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GAMMA RAY AND MICROWAVE EMISSION FROM 1991 JUNE EVENTS Abstract Only
Shinzo Enome, Hiroshi Nakajima, Hugh S. Hudson (California Univ., San Diego.), and Richard Schwartz *In its* The Compton Observatory Science Workshop Feb. 1992 p 522 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21947*# Glasgow Univ. (Scotland). Dept. of Physics and Astronomy.
FLARE GAMMA RAY CONTINUUM EMISSION FROM NEUTRAL PION DECAY
David Alexander and Alec L. MacKinnon *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 523-527 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21948*# Toyama Univ. (Japan). Lab. for Plasma Astrophysics and Fusion Science.
PROMPT PARTICLE ACCELERATION AROUND MOVING X-POINT MAGNETIC FIELD DURING IMPULSIVE PHASE OF SOLAR FLARES
Jun-Ichi Sakai *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 528-535 Sponsored in part by ELCO Company (For primary document see N92-21874 12-90)
(Grant ASR-ME-03640247)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21949*# Hawaii Univ., Honolulu. Inst. for Astronomy.
SEARCH FOR EVIDENCE OF LOW ENERGY PROTONS IN SOLAR FLARES
Thomas R. Metcalf, Jean-Pierre Wuelser, Richard C. Canfield, and Hugh S. Hudson *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 536-541 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21950*# Delaware Univ., Newark.
COSMIC RAY ALBEDO GAMMA RAYS FROM THE QUIET SUN
D. Seckel, T. Stanev, and T. K. Gaisser *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 542-549 (For primary document see N92-21874 12-90)
(Grants NAGw-1644; NAGw-2076)
Avail: NTIS HC/MF A24 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N92-21195# California Univ., Irvine. Dept. of Physics.
A RESEARCH PROGRAM IN NEUTRINO PHYSICS, COSMIC RAYS AND ELEMENTARY PARTICLES: TASKS A, B, C, D
H. W. Sobel Aug. 1991 5 p
(Contract DE-AT03-76SF-71019)
(DE92-007157; DOE/SF-71019/T2) Avail: NTIS HC/MF A01

A summary is given of the DOE supported high energy physics research at the University of California, Irvine. Physics interests of the group are focused primarily on tests of conservation laws and studies of fundamental interactions between particles. There is also a significant interest in astrophysics and cosmic rays. The DOE support has been divided into four tasks briefly described in this paper. DOE

N92-21324# Lawrence Livermore National Lab., CA.
ACCRETION DYNAMICS AND POLARIZED X RAY EMISSION OF MAGNETIZED NEUTRON STARS
J. Arons 15 Jul. 1991 11 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-007331; UCRL-JC-107773; CONF-9107115-69) Avail: NTIS HC/MF A03

The basic ideas of accretion onto magnetized neutron stars are outlined. These are applied to a simple model of the structure of the plasma mound sitting at the magnetic poles of such as star, in which upward diffusion of photons is balanced by their downward advection. This steady flow model of the plasma's dynamical state is used to compute the emission of polarized x

rays from the optically thick, birefringent medium. The linear polarization of the continuum radiation emerging from the quasi-static mound is found to be as much as 40 percent at some rotation phases, but is insensitive to the geometry of the accretion flow. The role of the accretion shock, whose detailed polarimetric and spectral characteristics have yet to be calculated, is emphasized as the final determinant of the properties of the emerging x rays. Some results describing the fully time dependent dynamics of the flow are also presented. In particular, steady flow onto a neutron star is shown to exhibit formation of 'photon bubbles', regions of greatly reduced plasma density filled with radiation which form and rise on millisecond time scales. The possible role of these complex structures in the flow for the formation of the emergent spectrum is briefly outlined. DOE

N92-21424 Hawaii Univ., Honolulu.
A SEARCH FOR VERY HIGH ENERGY GAMMA RAY EMISSION FROM HERCULES X-1 Ph.D. Thesis
Linda Ann Kelley 1991 229 p
Avail: Univ. Microfilms Order No. DA9205863

Data from the Haleakala Gamma-ray Observatory taken during 1987 and 1989 is searched for the presence of TeV Gamma-rays from the direction of Hercules X-1. These two data sets were compiled on two different instruments: the first in operation from 1985 through the end of 1987 and the second, upgraded instrument in operation from early 1989 to the present. After the initial data selection and calibration, the two data segments were analyzed for periodicity near the interpolated pulse period, a counting rate (or DC) excess during short intervals, and an integrated DC excess over longer periods of time. The 1987 data set revealed one interval of significant periodicity. The detected period, 1.23578 + or - 0.00020 s, is not in agreement with the expected X-ray pulse period, but it is in agreement with periodicity observed from the Her X-1 by several groups during 1986 in the TeV-PeV energy range. No significant rate excess was observed during this interval. An integrated DC excess calculation was not possible on these data because of the mode in which the data were taken. The 1989 data set contained no periodicity; however, an integrated excess corresponding to two of the three high on X-ray intervals during which data was taken was observed. The overflow flux observed during this year was (5.9 + or -2.6) x 10(exp -11) cm(exp -2) s(exp -1) above 0.15 TeV. No significant short (15 minute) bursts of VHE gamma-rays were detected in this data set.
Dissert. Abstr.

N92-21881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GAMMA RAY BURST SOURCE LOCATIONS WITH THE NEW INTERPLANETARY NETWORK Abstract Only
T. L. Cline, Gerald Fishman, Kevin Hurley, John Laros, Neils Lund, and Michael Sommer (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 60 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21882*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
DESCRIPTION OF A SUBSET OF SINGLE EVENTS FROM THE BATSE GAMMA RAY BURST DATA
Chryssa Kouveliotou, William S. Paciesas (Alabama Univ., Huntsville.), Gerald J. Fishman, Charles A. Meegan, and Robert B. Wilson *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 61-68 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21883*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
OCCULTATION ANALYSIS OF BATSE DATA: OPERATIONAL ASPECTS
B. A. Harmon, M. H. Finger, B. Rubin, R. Mallozzi, W. S. Paciesas (Alabama Univ., Huntsville.), R. B. Wilson, G. J. Fishman, M. Brock, and C. A. Meegan *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 69-75 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21891*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
NEURAL NETWORK CLASSIFICATION OF QUESTIONABLE EGRET EVENTS
C. A. Meetre and J. P. Norris *In its* The Compton Observatory Science Workshop Feb. 1992 p 137-144 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21895*# Rice Univ., Houston, TX. Dept. of Space Physics and Astronomy.
SOFT GAMMA RAYS FROM BLACK HOLES VERSUS NEUTRON STARS
Edison P. Liang *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 173-184 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21896*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MONITORING CEN X-3 WITH BATSE
Mark H. Finger, Robert B. Wilson, Charles A. Meegan, William S. Paciesas (Alabama Univ., Huntsville.), and Gerald J. Fishman *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 185-192 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21897*# Calgary Univ. (Alberta). Dept. of Physics and Astronomy.
THE 144 SECOND PERIODIC FLUX VARIATIONS DURING X RAY TURN-ON OF HERCULES X-1
D. A. Leahy, A. Yoshida, N. Kawai, and M. Matsuoka (Institute of Physical and Chemical Research, Saitama, Japan) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 193-200 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21899*# Commissariat a l'Energie Atomique, Saclay (France). Service d'Astrophysique.
DETECTION AND PERIOD MEASUREMENTS OF GX1+4 AT HARD X RAY ENERGIES WITH THE SIGMA TELESCOPE
Ph. Laurent, L. Salotti, F. Lebrun, J. Paul, M. Denis, D. Barret, E. Jourdain, J. P. Roques, E. Churazov, and M. Gilfanov (Academy of Sciences, USSR, Moscow) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 209-216 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21900*# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.
HARD X RAY OBSERVATIONS OF VELA X-1 AND A0535+26 WITH HEXE: DISCOVERY OF CYCLOTRON LINES Abstract Only
E. Kendziorra, B. Mony, P. Kretschmar, M. Maisack, R. Staubert, S. Doebereiner, J. Englhauser, W. Pietsch, C. Reppin, and J. Truemper (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany, F.R.) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 217 Prepared in cooperation with Academy of Sciences (USSR), Moscow (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21901*# Los Alamos National Lab., NM.
GAMMA RAYS FROM THE CRAB AND VELA PULSARS Abstract Only

Cheng Ho *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 221 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21903*# Lawrence Livermore National Lab., CA. Inst. of Geophysics and Planetary Physics.
GAMMA RAYS FROM HIDDEN MILLISECOND PULSARS
Marco Tavani *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 229-236 Prepared in cooperation with California Univ., Berkeley (For primary document see N92-21874 12-90)
(Contract W-7405-eng-48; GRO-90-29; GRO-PFP-91-23)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21904*# Stanford Univ., CA. Dept. of Physics.
PULSAR GAMMA RAYS FROM POLAR CAP REGIONS
James Chiang and Roger W. Romani *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 237-244 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21909*# Chicago Univ., IL. Dept. of Astronomy and Astrophysics.
ISSUES IN THE ANALYSIS AND INTERPRETATION OF CYCLOTRON LINES IN GAMMA RAY BURSTS
D. Q. Lamb *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 275-286 (For primary document see N92-21874 12-90)
(Grants NAGw-830; NAGw-1284)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21910*# Princeton Univ. Observatory, NJ.
ON THE GALACTIC ORIGIN OF GAMMA RAY BURSTS Abstract Only
Bohdan Paczynski *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 287 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ULYSSES/BATSE OBSERVATIONS OF COSMIC GAMMA RAY BURSTS
K. Hurley, M. Boer, M. Sommer, G. Fishman, C. Meegan, W. Paciesas, R. Wilson, C. Kouveliotou (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.), and T. Cline *In its* The Compton Observatory Science Workshop Feb. 1992 p 288-292 (For primary document see N92-21874 12-90)
(Contract NAG5-1560; JPL-958056)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21912*# North Carolina State Univ., Raleigh. Dept. of Physics.
MAGNETIC PHOTON SPLITTING AND GAMMA RAY BURST SPECTRA
Matthew G. Baring *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 293-300 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21913*# Space Telescope Science Inst., Baltimore, MD.
GAMMA RAY BURST ASTROMETRY 2: NUMERICAL TESTS
L. G. Taff and S. T. Holfeltz *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 301-308 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21914*# Lodz Univ. (Poland). Inst. of Physics.
UNTHERMALIZED POSITRONS IN GAMMA RAY BURST SOURCES
W. Tkaczyk and S. Karakula *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 309-316 Sponsored in part by Polish Ministry of Education (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21915*# Columbia Univ., New York, NY. Astrophysics Lab.
ULTRASOFT X RAY BURSTS: A CLUE TO THE ORIGIN OF GAMMA RAY BURSTS? Abstract Only
D. J. Helfand, E. Gotthelf, and T. T. Hamilton *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 317 (For primary document see N92-21874 12-90)
(Grant NAG8-183)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21916*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GAMMA RAY MONITORING OF A AGN AND GALACTIC BLACK HOLE CANDIDATES BY THE COMPTON GAMMA RAY OBSERVATORY
R. T. Skelton, James C. Ling, William A. Wheaton, Alan Harmon, G. J. Fishman, C. A. Meegan, William S. Paciesas, Duane E. Gruber, Brad Rubin, and R. B. Wilson (National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 321-327 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21917*# Rice Univ., Houston, TX. Dept. of Space Physics and Astronomy.
GAMMA RAYS FROM EXTRAGALACTIC RADIO SOURCES
Charles D. Dermer, Reinhard Schlickeiser, and Apostolos Mastichiadis (Max-Planck-Inst. fuer Kernphysik, Heidelberg, Germany, F.R.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 328-334 (For primary document see N92-21874 12-90)
(Grant NAG5-1547)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21920*# Boston Univ., MA. Dept. of Astronomy.
HARD GAMMA RAY EMISSION FROM BLAZARS
Alan P. Marscher and Steven D. Bloom *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 346-353 (For primary document see N92-21874 12-90)
(Grant NAG5-1566)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21921*# New Hampshire Univ., Durham. Space Science Center.
GAMMA RAYS FROM CLUSTERS OF GALAXIES Abstract Only
W. Thomas Vestrand *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 355 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21922*# George Mason Univ., Fairfax, VA. Dept. of Physics.
GAMMA RAY FLARES IN AGN
M. Kafatos *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 356-358 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21924*# Chicago Univ., IL. Dept. of Astronomy and Astrophysics.
X RAY AND GAMMA RAY EMISSION FROM CLASSICAL NOVA OUTBURSTS
James W. Truran, Sumner Starrfield, and Warren M. Sparks (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight

Center, The Compton Observatory Science Workshop Feb. 1992 p 369-376 Sponsored in part by NASA, NSF, and DOE (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21925*# Arizona State Univ., Tempe. Dept. of Physics and Astronomy.
A BURST FROM A THERMONUCLEAR RUNAWAY ON AN ONeMg WHITE DWARF
S. Starrfield, M. Politano, J. W. Truran, and W. M. Sparks (Los Alamos National Lab., NM.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 377-386 Sponsored in part by NASA; NSF; and DOE (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21926*# Arizona Univ., Tucson.
SUPERNOVAE AS SOURCES OF GAMMA RAYS Abstract Only
Adam Burrows *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 387 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21928*# Michigan Univ., Ann Arbor. Lab. of Physics.
LOCATING VERY HIGH ENERGY GAMMA RAY SOURCES WITH ARC MINUTE ACCURACY
C. W. Akerlof, M. F. Cawley, M. Chantell, D. J. Fegan, K. Harris, A. M. Hillas, D. G. Jennings, R. C. Lamb, M. A. Lawrence, and M. J. Lang (University Coll., Dublin, Ireland) et al *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 399-405 Previously announced in IAA as A91-48489 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21930*# Argonne National Lab., IL.
UNDERGROUND MUONS FROM THE DIRECTION OF CYGNUS X-3
M. L. Marshak *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 412-413 Prepared in cooperation with Minnesota Univ., Minneapolis; Oxford Univ. (England); Rutherford Appleton Lab.; and Tufts Univ Sponsored in part by DOE and UK Science and Engineering Research Council (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21932*# Space Telescope Science Inst., Baltimore, MD.
LOW ENERGY GAMMA RAY EMISSION FROM THE CYGNUS OB2 ASSOCIATION
Wan Chen and Richard L. White (Johns Hopkins Univ., Baltimore, MD.) *In* NASA. Goddard Space Flight Center, The Compton Observatory Science Workshop Feb. 1992 p 424-428 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
GRIS OBSERVATIONS OF THE GALACTIC CENTER AND THE GAMMA RAY GALACTIC DIFFUSE CONTINUUM
J. Tueller, S. Barthelmy, N. Gehrels, B. J. Teegarden, M. Leventhal, and C. J. MacCallum (New Mexico Univ., Albuquerque.) *In its* The Compton Observatory Science Workshop Feb. 1992 p 438-445 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

N92-21935*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE GAMMA RAY CONTINUUM SPECTRUM FROM THE GALACTIC CENTER DISK AND POINT SOURCES
Neil Gehrels and Jack Tueller *In its* The Compton Observatory Science Workshop Feb. 1992 p 446-454 (For primary document see N92-21874 12-90)
Avail: NTIS HC/MF A24 CSCL 03B

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N92-21264*# Texas A&M Univ., College Station.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM, 1991, VOLUME 1
William A. Hyman, ed. and Stanley H. Goldstein, ed. (National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.) Dec. 1991 282 p Fellowship program held in Houston, TX, 1991; sponsored by NASA, Washington (Grant NGT-44-001-800)
(NASA-CR-185670-Vol-1; NAS 1.26:185670-Vol-1) Avail: NTIS HC/MF A08 CSCL 05B

Presented here is a compilation of the final reports of the research projects done by the faculty members during the summer of 1991. Topics covered include optical correlation; lunar production and application of solar cells and synthesis of diamond film; software quality assurance; photographic image resolution; target detection using fractal geometry; evaluation of fungal metabolic compounds released to the air in a restricted environment; and planning and resource management in an intelligent automated power management system. For individual titles, see N92-21265 through N92-21278.

N92-21265*# Florida International Univ., Miami. Dept. of Industrial Engineering.
USE OF TAGUCHI DESIGN OF EXPERIMENTS TO DETERMINE ALPLS ASCENT DELTA-5 SENSITIVITIES AND TOTAL MASS SENSITIVITIES TO RELEASE CONDITIONS AND VEHICLE PARAMETERS Final Report **c16**
Hector Ramon Carrasco *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 12 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

The objective of this study is to evaluate the use of Taguchi's Design of Experiment Methods to improve the effectiveness of this and future parametric studies. Taguchi Methods will be applied in addition to the typical approach to provide a mechanism for comparing the results and the cost or effort necessary to complete the studies. It is anticipated that results of this study should include an improved systematic analysis process, an increase in information obtained at a lower cost, and a more robust, cost effective vehicle design. Author

N92-21266*# Military Academy, West Point, NY. Dept. of Physics.
OPTICAL CORRELATION Final Report **c74**
Steven S. Cotariu *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 12 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 20F

Pattern recognition may supplement or replace certain navigational aids on spacecraft in docking or landing activities. The need to correctly identify terrain features remains critical in preparation of autonomous planetary landing. One technique that may solve this problem is optical correlation. Correlation has been successfully demonstrated under ideal conditions; however, noise significantly affects the ability of the correlator to accurately identify input signals. Optical correlation in the presence of noise must be successfully demonstrated before this technology can be incorporated into system design. An optical correlator is designed and constructed using a modified 2f configuration. Liquid crystal televisions (LCTV) are used as the spatial light modulators (SLM) for both the input and filter devices. The filter LCTV is characterized and an operating curve is developed. Determination of this operating curve is critical for reduction of input noise. Correlation of live input with a programmable filter is demonstrated. Author

N92-21267*# City Univ. of New York, Bronx. Dept. of Physics and Astronomy.

INVESTIGATION OF TECHNIQUES FOR SIMULATING COMMUNICATIONS AND TRACKING SUBSYSTEMS ON SPACE STATION FREEDOM Final Report **c18**

Louis A. DeAcetis *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 8 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

The need to reduce the costs of Space Station Freedom has resulted in a major redesign and downsizing of the Station in general, and its Communications and Tracking (C&T) components in particular. Earlier models and simulations of the C&T Space-to-Ground Subsystem (SGS) in particular are no longer valid. There thus exists a general need for updated, high fidelity simulations of C&T subsystems. This project explored simulation techniques and methods that might be used in developing new simulations of C&T subsystems, including the SGS. Three requirements were placed on the simulations to be developed: (1) they run on IBM PC/XT/AT compatible computers; (2) they be written in Ada as much as possible; and (3) since control and monitoring of the C&T subsystems will involve communication via a MIL-STD-1553B serial bus, that the possibility of commanding the simulator and monitoring its sensors via that bus be included in the design of the simulator. The result of the project is a prototype of a simulation of the Assembly/Contingency Transponder of the SGS, written in Ada, which can be controlled from another PC via a MIL-STD-1553B bus. Author

N92-21268*# Houston Univ., TX. Dept. of Industrial Engineering.

AN EXPLORATORY EXERCISE IN TAGUCHI ANALYSIS OF DESIGN PARAMETERS: APPLICATION TO A SHUTTLE-TO-SPACE STATION AUTOMATED APPROACH CONTROL SYSTEM Final Report **c16**

Don E. Deal *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 10 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 22B

The chief goals of the summer project have been twofold - first, for my host group and myself to learn as much of the working details of Taguchi analysis as possible in the time allotted, and, secondly, to apply the methodology to a design problem with the intention of establishing a preliminary set of near-optimal (in the sense of producing a desired response) design parameter values from among a large number of candidate factor combinations. The selected problem is concerned with determining design factor settings for an automated approach program which is to have the capability of guiding the Shuttle into the docking port of the Space Station under controlled conditions so as to meet and/or optimize certain target criteria. The candidate design parameters under study were glide path (i.e., approach) angle, path intercept and approach gains, and minimum impulse bit mode (a parameter which defines how Shuttle jets shall be fired). Several performance criteria were of concern: terminal relative velocity at the instant the two spacecraft are mated; docking offset; number of Shuttle jet firings in certain specified directions (of interest due to possible plume impingement on the Station's solar arrays), and total RCS (a measure of the energy expended in performing the approach/docking maneuver). In the material discussed here, we have focused on single performance criteria - total RCS. An analysis of the possibility of employing a multiobjective function composed of a weighted sum of the various individual criteria has been undertaken, but is, at this writing, incomplete. Results from the Taguchi statistical analysis indicate that only three of the original four posited factors are significant in affecting RCS response. A comparison of model simulation output (via Monte Carlo) with predictions based on estimated factor effects inferred through the Taguchi experiment array data suggested acceptable or close agreement between the two except at the predicted optimum point, where a difference outside a rule-of-thumb bound was observed. We have concluded that there is most likely an interaction effect not provided for in the original orthogonal array selected as the basis for our experimental design. However, we feel that the data indicates that this interaction is a mild one and that inclusion of its effect will not alter the location of the optimum. Author

N92-21269*# Boston Coll., Chestnut Hill, MA. Inst. for Space Research.

LUNAR PRODUCTION AND APPLICATION OF SOLAR CELLS, AND SYNTHESIS OF DIAMOND FILM Final Report **c44**

P. H. Fang *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 10B

Two projects which are carried out under the Summer Faculty Fellowship Program-1991 are discussed. A conceptual design of a solar cell manufacturing plant on a lunar base is discussed. This is a large program that requires a continuous and expanded effort, the present status of which is reflected here. An experiment on the synthesis of diamond film is discussed. Encouraging, but not yet conclusive evidence has been obtained on a new method to synthesize diamond film. The procedures and observations are presented. A third project is an analysis of the solar cell performance over five years on the moon based on Apollo missions. A paper has been completed and will be submitted to the journal Solar Cells for publication. Author

N92-21270*# Houston Univ., Clear Lake, TX. Dept. of Biological and Allied Health Sciences.

EVALUATION OF FUNGAL METABOLIC COMPOUNDS RELEASED TO THE AIR IN A RESTRICTED ENVIRONMENT Final Report **c45**

Robert N. Ferebee *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 7 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 13B

The metabolic action of selected fungi species on common components of the interior of Space Station Freedom (SSF) will be tested. When present, volatile organic chemicals will be collected on porous polymer adsorbent columns. Using thermal desorption, the volatile compounds will be passed onto a gas chromatographic column for analysis. The Space Station Freedom (SSF) modular complex will largely be individually self contained and the established air environment will not be easily adjusted. The development and maintenance of a safe working environment offers a considerable challenge. Present plans for use of SSF acknowledge periods of manned activities and alternate times when the station is unmanned. The obvious necessity for clean and safe air and water during periods of use have been pursued as fundamental systems to SSF success. Somewhat less obvious, although perhaps of no less importance to the success of long term cyclic usage, are those periods of inactivity. It is during these periods when spores from microorganisms may be afforded the best conditions to germinate and in the vegetative form react with the complex synthetic chemical polymers which compose the furnishings and hardware of SSF nodes. Biodegradation could constitute a real hygiene problem, if the organisms form and release volatile organic chemicals. Similar problems have been documented in closed and improperly ventilated buildings and work spaces. Many of the metabolic products of fungi and bacterial growth create a variety of health problems. Analytical chemical techniques will first be used to document the growth of Aspergillus, Penicillium, and Cladosporium fungal species on the potential substrates Nomex and Kevlar. Any volatile organics that are released will be measured using the spectrum of gas adsorption chromatography. The level of microbial contamination that is necessary to produce such volatile compounds and the relative amounts expected to accumulate will be estimated. Author

N92-21271*# West Virginia Inst. of Tech., Montgomery. Dept. of Mathematics.

TARGET DETECTION USING FRACTAL GEOMETRY Final Report **c61**

J. Joseph Fuller *In* Texas A and M Univ., NASA/ASEE Summer

Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 9 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 09B

The concepts and theory of fractal geometry were applied to the problem of segmenting a 256 x 256 pixel image so that manmade objects could be extracted from natural backgrounds. The two most important measurements necessary to extract these manmade objects were fractal dimension and lacunarity. Provision was made to pass the manmade portion to a lookup table for subsequent identification. A computer program was written to construct cloud backgrounds of fractal dimensions which were allowed to vary between 2.2 and 2.8. Images of three model space targets were combined with these backgrounds to provide a data set for testing the validity of the approach. Once the data set was constructed, computer programs were written to extract estimates of the fractal dimension and lacunarity on 4 x 4 pixel subsets of the image. It was shown that for clouds of fractal dimension 2.7 or less, appropriate thresholding on fractal dimension and lacunarity yielded a 64 x 64 edge-detected image with all or most of the cloud background removed. These images were enhanced by an erosion and dilation to provide the final image passed to the lookup table. While the ultimate goal was to pass the final image to a neural network for identification, this work shows the applicability of fractal geometry to the problems of image segmentation, edge detection and separating a target of interest from a natural background. Author

N92-21272*# Mary Hardin-Baylor Univ., Belton, TX. Dept. of Mathematics and Physics.
CLOSED-LOOP HABITATION AIR REVITALIZATION MODEL FOR REGENERATIVE LIFE SUPPORT SYSTEMS Final Report c54
Maxwell M. Hart *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 05H

The primary function of any life support system is to keep the crew alive by providing breathable air, potable water, edible food, and for disposal of waste. In a well-balanced or regenerative life support system, the various components are each using what is available and producing what is needed by other components so that there will always be enough chemicals in the form in which they are needed. Humans are not just users, but also one of the participating parts of the system. If a system could continuously recycle the original chemicals, this would make it virtually a Closed-loop Habitation (CH). Some difficulties in trying to create a miniature version of a CH are briefly discussed. In a miniature CH, a minimal structure must be provided and the difference must be made up by artificial parts such as physicochemical systems that perform the conversions that the Earth can achieve naturally. To study the interactions of these parts, a computer model was designed that simulates a miniature CH with emphasis on the air revitalization part. It is called the Closed-loop Habitation Air Revitalization Model (CHARM). Author

N92-21273*# Texas A&M Univ., Galveston. Dept. of Marine Science.
PHOTOGRAPHIC IMAGE RESTORATION Final Report c35
Gerald E. Hite *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 14B

Deblurring capabilities would significantly improve the Flight Science Support Office's ability to monitor the effects of lift-off on the shuttle and landing on the orbiter. A deblurring program was written and implemented to extract information from blurred images containing a straight line or edge and to use that information to deblur the image. The program was successfully applied to an image blurred by improper focussing and two blurred by different amounts of blurring. In all cases, the reconstructed modulation transfer function not only had the same zero contours as the Fourier transform of the blurred image but the associated point spread function also had structure not easily described by simple parameterizations. The difficulties posed by the presence of noise in the blurred image necessitated special consideration. An amplitude modification technique was developed for the zero contours of the modulation transfer function at low to moderate frequencies and a smooth filter was used to suppress high frequency noise. Author

N92-21274*# Houston Baptist Univ., TX. Dept. of Biology.
THE APPLICABILITY OF NONLINEAR SYSTEMS DYNAMICS CHAOS MEASURES TO CARDIOVASCULAR PHYSIOLOGY VARIABLES Final Report c52
John C. Hooker *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 7 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 06P

Three measures of nonlinear chaos (fractal dimension, Approximate Entropy (ApEn), and Lyapunov exponents) were studied as potential measures of cardiovascular condition. It is suggested that these measures have potential in the assessment of cardiovascular condition in environments of normal cardiovascular stress (normal gravity on the Earth surface), cardiovascular deconditioning (microgravity of space), and increased cardiovascular stress (lower body negative pressure (LBNP) treatments). Author

N92-21275*# Texas Univ., San Antonio. Div. of Engineering.
A LOCAL CONDENSATION ANALYSIS REPRESENTING TWO-PHASE ANNULAR FLOW IN CONDENSER/RADIATOR CAPILLARY TUBES Final Report c34
Amir Karimi *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 15 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 20D

NASA's effort for the thermal environmental control of the Space Station Freedom is directed towards the design, analysis, and development of an Active Thermal Control System (ATCS). A two phase, flow through condenser/radiator concept was baselined, as a part of the ATCS, for the radiation of space station thermal load into space. The proposed condenser rejects heat through direct condensation of ATCS working fluid (ammonia) in the small diameter radiator tubes. Analysis of the condensation process and design of condenser tubes are based on the available two phase flow models for the prediction of flow regimes, heat transfer, and pressure drops. The prediction formulas use the existing empirical relationships of friction factor at gas-liquid interface. An attempt is made to study the stability of interfacial waves in two phase annular flow. The formulation is presented of a stability problem in cylindrical coordinates. The contribution of fluid viscosity, surface tension, and transverse radius of curvature to the interfacial surface is included. A solution is obtained for Kelvin-Helmholtz instability problem which can be used to determine the critical and most dangerous wavelengths for interfacial waves. Author

N92-21276*# Kansas State Univ., Manhattan. Dept. of Kinesiology.
RESOLVING SENSORY CONFLICT: THE EFFECT OF MUSCLE VIBRATION ON POSTURAL STABILITY Final Report c52
Charles S. Layne *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 14 p
(For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 06P

The otolith-tilt reinterpretation hypothesis (OTTR) proposes that the central nervous system adapts to weightlessness by reinterpreting all otolith input as linear motion. While interpreting otolith input exclusively as linear motion is functionally useful in space, it is maladaptive upon return to Earth. Astronauts have reported experiencing illusory sensations during head movement which contributes to postural instability. The effect is assessed of muscle vibration in combination with a variety of sensory conflicts on postural equilibrium. The equilibrium of six healthy subjects was tested using the EquiTest sensory test protocol, with and without the confounding influence of triceps surea vibration. The data were analyzed with repeated measures with vibration, vision

status, and platform status as independent variables. All main effects and an interaction between the presence of vision and platform sway referencing were found to be significant. Overall, a 4.5 pct. decrease in postural stability was observed with vibration. The trend of the difference scores between conditions with and without vibration suggests that vibration is most destabilizing when the triceps surea is able to change length during postural sway (i.e., conditions with a fixed support surface). The impact of sway referencing vision was virtually identical to that of eye closure, providing compelling evidence that sway referencing 'nulls out' useful cues about subject sway. Author

N92-21277*# Houston Univ., TX. Dept. of Computer Science.
TRAINING, QUALITY ASSURANCE FACTORS, AND TOOLS INVESTIGATION: A WORK REPORT AND SUGGESTIONS ON SOFTWARE QUALITY ASSURANCE Final Report c61
Pen-Nan Lee *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 10 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 09B

Previously, several research tasks have been conducted, some observations were obtained, and several possible suggestions have been contemplated involving software quality assurance engineering at NASA Johnson. These research tasks are briefly described. Also, a brief discussion is given on the role of software quality assurance in software engineering along with some observations and suggestions. A brief discussion on a training program for software quality assurance engineers is provided. A list of assurance factors as well as quality factors are also included. Finally, a process model which can be used for searching and collecting software quality assurance tools is presented. Author

N92-21278*# Florida Inst. of Tech., Melbourne. Dept. of Computer Science.
PLANNING AND RESOURCE MANAGEMENT IN AN INTELLIGENT AUTOMATED POWER MANAGEMENT SYSTEM Final Report c20
Robert A. Morris *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 1 Dec. 1991 16 p (For primary document see N92-21264 12-99)
Avail: NTIS HC/MF A13 CSCL 10B

Power system management is a process of guiding a power system towards the objective of continuous supply of electrical power to a set of loads. Spacecraft power system management requires planning and scheduling, since electrical power is a scarce resource in space. The automation of power system management for future spacecraft has been recognized as an important R&D goal. Several automation technologies have emerged including the use of expert systems for automating human problem solving capabilities such as rule based expert system for fault diagnosis and load scheduling. It is questionable whether current generation expert system technology is applicable for power system management in space. The objective of the ADEPTS (ADvanced Electrical Power management Techniques for Space systems) is to study new techniques for power management automation. These techniques involve integrating current expert system technology with that of parallel and distributed computing, as well as a distributed, object-oriented approach to software design. The focus of the current study is the integration of new procedures for automatically planning and scheduling loads with procedures for performing fault diagnosis and control. The objective is the concurrent execution of both sets of tasks on separate transputer processors, thus adding parallelism to the overall management process. Author

N92-21300*# Texas A&M Univ., College Station.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)/AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) SUMMER FACULTY FELLOWSHIP PROGRAM, 1991, VOLUME 2
William A. Hyman, ed. and Stanley H. Goldstein, ed. (National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.) Dec. 1991 188 p Fellowship program held in Houston, TX, 1991; sponsored by NASA, Washington (Grant NGT-44-001-800)
(NASA-CR-185670-Vol-2; NAS 1.26:185670-Vol-2) Avail: NTIS HC/MF A09 CSCL 05B

The objectives of the program are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participant's institutions; and (4) to contribute to the research objectives of the NASA Centers. A compilation of the final reports on the research projects done by the faculty fellows during the summer of 1991 are presented. Some of the topics covered include: collision avoidance for rover vehicles, bioinstrumentation, neural nets, total quality management of flexible space structures, project scheduling, nondestructive tests, orthostatic intolerance to bedrest, hypersonic reentry simulation, measuring human energy expenditure, tribological models, trace element movement in Anarctic ice, gastrointestinal function, and computer assisted instruction. For individual titles, see N92-21301 through N92-21313.

N92-21301*# Houston Univ., TX. Dept. of Applied Mathematical Sciences.
FUZZY LOGIC PATH PLANNING SYSTEM FOR COLLISION AVOIDANCE BY AN AUTONOMOUS ROVER VEHICLE Final Report c63
Michael G. Murphy *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 10 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

Systems already developed at JSC have shown the benefits of applying fuzzy logic control theory to space related operations. Four major issues are addressed that are associated with developing an autonomous collision avoidance subsystem within a path planning system designed for application in a remote, hostile environment that does not lend itself well to remote manipulation of the vehicle involved through Earth-based telecommunication. A good focus for this is unmanned exploration of the surface of Mars. The uncertainties involved indicate that robust approaches such as fuzzy logic control are particularly appropriate. The four major issues addressed are: (1) avoidance of a single fuzzy moving obstacle; (2) back off from a dead end in a static obstacle environment; (3) fusion of sensor data to detect obstacles; and (4) options for adaptive learning in a path planning system.
Author

N92-21302*# Mercer Univ., Macon, GA. Dept. of Biomedical Engineering.
AN INVESTIGATIVE REDESIGN OF THE ECG AND EMG SIGNAL CONDITIONING CIRCUITS FOR TWO-FAULT TOLERANCE AND CIRCUIT IMPROVEMENT Final Report c33
Edward M. OBrien *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09C

An investigation was undertaken to make the elctrocardiography (ECG) and the electromyography (EMG) signal conditioning circuits two-fault tolerant and to update the circuitry. The present signal conditioning circuits provide at least one level of subject protection against electrical shock hazard but at a level of 100 micro-A (for voltages of up to 200 V). However, it is necessary to provide catastrophic fault tolerance protection for the astronauts and to provide protection at a current level of less that 100 micro-A. For this study, protection at the 10 micro-A level was sought. This is the generally accepted value below which no possibility of microshock exists. Only the possibility of macroshock exists in the case of the signal conditioners. However, this extra amount of protection is desirable. The initial part deals with current limiter circuits followed by an investigation into the signal conditioner specifications and circuit design. Author

N92-21303*# Clemson Univ., SC. Dept. of Mathematical Sciences.
NEURAL ARCHITECTURES FOR CONTROL Final Report c63
James K. Peterson *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 17 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

The cerebellar model articulated controller (CMAC) neural architectures are shown to be viable for the purposes of real-time learning and control. Software tools for the exploration of CMAC performance are developed for three hardware platforms, the MacIntosh, the IBM PC, and the SUN workstation. All algorithm development was done using the C programming language. These software tools were then used to implement an adaptive critic neuro-control design that learns in real-time how to back up a trailer truck. The truck backer-upper experiment is a standard performance measure in the neural network literature, but previously the training of the controllers was done off-line. With the CMAC neural architectures, it was possible to train the neuro-controllers on-line in real-time on a MS-DOS PC 386. CMAC neural architectures are also used in conjunction with a hierarchical planning approach to find collision-free paths over 2-D analog valued obstacle fields. The method constructs a coarse resolution version of the original problem and then finds the corresponding coarse optimal path using multipass dynamic programming. CMAC artificial neural architectures are used to estimate the analog transition costs that dynamic programming requires. The CMAC architectures are trained in real-time for each obstacle field presented. The coarse optimal path is then used as a baseline for the construction of a fine scale optimal path through the original obstacle array. These results are a very good indication of the potential power of the neural architectures in control design. In order to reach as wide an audience as possible, we have run a seminar on neuro-control that has met once per week since 20 May 1991. This seminar has thoroughly discussed the CMAC architecture, relevant portions of classical control, back propagation through time, and adaptive critic designs. Author

N92-21304*# Pennsylvania State Univ., University Park. Dept. of Industrial and Systems Engineering.
TOTAL QUALITY MANAGEMENT: ANALYSIS, EVALUATION AND IMPLEMENTATION WITHIN ACRV PROJECT TEAMS Final Report c81
Laura B. Raiman *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 12 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05A

Total quality management (TQM) is a cooperative form of doing business that relies on the talents of everyone in an organization to continually improve quality and productivity, using teams and an assortment of statistical and measurement tools. The Assured Crew Return Vehicle (ACRV) Project Office was identified as an excellent project in which to demonstrate the applications and benefits of TQM processes. As the ACRV Program moves through its various stages of development, it is vital that effectiveness and efficiency be maintained in order to provide the Space Station Freedom (SSF) crew an affordable, on-time assured return to Earth. A critical factor for the success of the ACRV is attaining the maximum benefit from the resources applied to the program. Through a series of four tutorials on various quality improvement techniques, and numerous one-on-one sessions during the SSF's 10-week term in the project office, results were obtained which are aiding the ACRV Office in implementing a disciplined, ongoing process for generating fundamental decisions and actions that shape and guide the organization. Significant advances were made in improving the processes for two particular groups - the correspondence distribution team and the WATER Test team. Numerous people from across JSC were a part of the various team activities including engineering, man systems, and safety. The work also included significant interaction with the support contractor to the ACRV Project. The results of the improvement activities can be used as models for other organizations desiring to operate under a system of continuous improvement. In particular, they have advanced the ACRV Project Teams further down the path of continuous improvement, in support of a working philosophy of TQM. Author

N92-21305*# Ambassador Coll., Big Sandy, TX. Dept. of Computer Information Systems.
ANALYSIS OF ISSUES FOR PROJECT SCHEDULING BY MULTIPLE, DISPERSED SCHEDULERS (DISTRIBUTED SCHEDULING) AND REQUIREMENTS FOR MANUAL PROTOCOLS AND COMPUTER-BASED SUPPORT Final Report c81
Stephen F. Richards *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 8 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05A

Although computerized operations have significant gains realized in many areas, one area, scheduling, has enjoyed few benefits from automation. The traditional methods of industrial engineering and operations research have not proven robust enough to handle the complexities associated with the scheduling of realistic problems. To address this need, NASA has developed the computer-aided scheduling system (COMPASS), a sophisticated, interactive scheduling tool that is in wide-spread use within NASA and the contractor community. Therefore, COMPASS provides no explicit support for the large class of problems in which several people, perhaps at various locations, build separate schedules that share a common pool of resources. This research examines the issue of distributing scheduling, as applied to application domains characterized by the partial ordering of tasks, limited resources, and time restrictions. The focus of this research is on identifying issues related to distributed scheduling, locating applicable problem domains within NASA, and suggesting areas for ongoing research. The issues that this research identifies are goals, rescheduling requirements, database support, the need for communication and coordination among individual schedulers, the potential for expert system support for scheduling, and the possibility of integrating artificially intelligent schedulers into a network of human schedulers. Author

N92-21306*# California Univ., San Diego, La Jolla. Dept. of AMES.
NONDESTRUCTIVE STRUCTURAL DAMAGE DETECTION IN FLEXIBLE SPACE STRUCTURES USING VIBRATION CHARACTERIZATION Final Report c18
James M. Ricles *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 17 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 22B

Spacecraft are susceptible to structural damage over their operating life from impact, environmental loads, and fatigue. Structural damage that is not detected and not corrected may potentially cause more damage and eventually catastrophic structural failure. NASA's current fleet of reusable spacecraft, namely the Space Shuttle, has been flown on several missions. In addition, configurations of future NASA space structures, e.g. Space Station Freedom, are larger and more complex than current structures, making them more susceptible to damage as well as being more difficult to inspect. Consequently, a reliable structural damage detection capability is essential to maintain the flight safety of these structures. Visual inspections alone can not locate impending material failure (fatigue cracks, yielding); it can only observe post-failure situations. An alternative approach is to develop an inspection and monitoring system based on vibration characterization that assesses the integrity of structural and mechanical components. A methodology for detecting structural damage is presented. This methodology is based on utilizing modal test data in conjunction with a correlated analytical model of the structure to: (1) identify the structural dynamic characteristics (resonant frequencies and mode shapes) from measurements of ambient motions and/or force excitation; (2) calculate modal residual force vectors to identify the location of structural damage; and (3) conduct a weighted sensitivity analysis in order to assess the extent of mass and stiffness variations, where structural damage

is characterized by stiffness reductions. The approach is unique from other existing approaches in that varying system mass and stiffness, mass center locations, the perturbation of both the natural frequencies and mode shapes, and statistical confidence factors for structural parameters and experimental instrumentation are all accounted for directly. Author

N92-21307*# Saint Louis Univ., MO. School of Nursing.
EVALUATION OF CUTANEOUS BLOOD FLOW DURING LOWER BODY NEGATIVE PRESSURE TO PREVENT ORTHOSTATIC INTOLERANCE OF BEDREST Final Report **c52**
Marilyn Rubin *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 9 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 06P

Orthostatic tolerance is markedly impaired in most of the crewmembers during space flight and could seriously compromise crew safety during and immediately after landing. NASA investigators are studying the use of lower body negative pressure (LBNP) as a countermeasure to this intolerance. It is hypothesized that the continuously changing vascular pressure induced by sinusoidal LBNP with an additional countermeasure of salt and water will help crewmembers to be in a more acceptable physiologic condition to enter the earth's atmosphere. In ground based studies, subjects on bedrest provide the model for studying the physiologic effects of weightlessness. When subjects are treated with sinusoidal LBNP, negative pressures ranging from 0 to -60 mm/Hg are administered during a two hour period. This increases body fluids in the legs and lower body. This paper reports the results of two subjects who were placed on bedrest for six days. The subjects were randomly selected for either the control or treatment mode. The subject receiving the treatment mode ingested salt tablets and water on day 4 of the bedrest period. A ramp LBNP of two hours was next administered to this subject. The control subject did not receive anything during the bedrest period. Laser Doppler was used to measure the cutaneous blood flow of the forearm and calf to monitor vasoconstrictor effects of the baroreceptor reflex. Data indicated that skin blood flow in the treatment subject was higher than baseline in the forearm while the skin blood flow was decreased in the control subject. Author

N92-21308*# Houston Univ., TX. Dept. of Mathematics.
THE DEVELOPMENT OF HIGH ORDER NUMERICAL TECHNIQUES FOR REENTRY SIMULATION OF HYPERSONIC SPACECRAFT Final Report **c18**
Richard Sanders *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 16 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 22B

The primary difficulty encountered when simulating hypersonic flow is that the flow normally includes strong nonlinear discontinuities. These discontinuities fall into three broad classes: shocks, slip-lines, and rarefaction waves. Moreover, in the hypersonic flow regime, the chemistry of hot gases plays a vital role and can not be neglected. These facts combine to make the numerical treatment of spacecraft reentry a most challenging problem. In this work, we develop a class of finite difference schemes that accurately resolve discontinuous solutions to spacecraft reentry flow and are simple to incorporate into existing spacecraft reentry codes. Author

N92-21309*# Wisconsin Univ., Milwaukee. Dept. of Health Sciences.
THE DOUBLY LABELED WATER METHOD FOR MEASURING HUMAN ENERGY EXPENDITURE: ADAPTATIONS FOR SPACEFLIGHT Final Report **c54**
Leslie O. Schulz *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 7 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 05H

It is essential to determine human energy requirements in space, and the doubly labeled water method has been identified as the most appropriate means of indirect calorimetry to meet this need. The method employs naturally occurring, stable isotopes of hydrogen (H-2, deuterium) and oxygen (O-18) which, after dosing, mix with body water. The deuterium is lost from the body as water while the O-18 is eliminated as both water and CO2. The difference between the two isotope elimination rates is therefore a measure of CO2 production and hence energy expenditure. Spaceflight will present a unique challenge to the application of the doubly labeled water method. Specifically, interpretation of doubly labeled water results assumes that the natural abundance or 'background' levels of the isotopes remain constant during the measurement interval. To address this issue, an equilibration model will be developed in an ongoing ground-based study. As energy requirements of women matched to counterparts in the Astronauts Corps are being determined by doubly labeled water, the baseline isotope concentration will be changed by consumption of 'simulated Shuttle water' which is artificially enriched. One group of subjects will be equilibrated on simulated Shuttle water prior to energy determinations by doubly labeled water while the others will consume simulated Shuttle water after dosing. This process will allow us to derive a prediction equation to mathematically model the effect of changing background isotope concentrations.
Author

N92-21310*# New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.
MODEL OF THE FRICTIONAL HEATING OF INCONEL 718 AND TITANIUM (Ti-6Al-4V) IN HELIUM Final Report **c26**
Christopher T. Skowlund *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 11F

A computer model of the frictional heating of metals in an inert environment has been developed. The model incorporates the effects of the heat loss from the samples due to conduction, radiation, and convection to the surroundings. This model allows the measured temperatures to be used to determine the amount of heat produced at the interface during the experiment by the sliding contact of two different metallic samples. The results of the simulation for an experiment run at the NASA White Sands Test Facility (WSTF) show that for the same heat production at the interface the heat losses have a significant effect on the temperatures in the samples. But, the heat losses do not significantly affect the different calculated heat flows (or friction coefficients), at the interface, that are necessary to correlate the measured temperatures. Author

N92-21311*# Alma Coll., MI. Dept. of Chemistry.
MOVEMENT OF TRACE ELEMENTS DURING RESIDENCE IN THE ANTARCTIC ICE: A LABORATORY SIMULATION Final Report **c48**
Melissa M. Strait *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 15 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 08L

Recent work has determined that differences in the trace element distribution between Antarctic eucrites and non-Antarctic eucrites may be due to weathering during residence in the ice, and samples that demonstrate trace element disturbances do not necessarily correspond to eucrites that appear badly weathered to the naked eye. This study constitutes a preliminary test of the idea that long-term residence in the ice is the cause of the trace element disturbances observed in the eucrites. Samples of a non-Antarctic eucrite were leached in water at room temperature conditions. Liquid samples were analyzed for rare earth element abundances using ion chromatography. The results for the short-term study showed little or no evidence that leaching had occurred. However, there were tantalizing hints that something may be happening. The residual solid samples are currently being analyzed for the unleached trace metals using instrumental neutron activation analysis and should show evidence of disturbance if the chromatography clues were real. In addition, another set of samples continues to be intermittently sampled for later analysis.

The results should give us information about the movement of trace elements under our conditions and allow us to make some tentative extrapolations to what we observe in actual Antarctic eucrite samples. Author

N92-21312*# Philadelphia Coll. of Pharmacy and Science, PA. Dept. of Pharmacy Practice.

NONINVASIVE pH-TELEMETRIC MEASUREMENT OF GASTROINTESTINAL FUNCTION Final Report **c52**

Karen J. Tietze *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 21 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 06P

The purpose of this study was to gain experience with and validate the Heidelberg pH-telemetric methodology in order to determine if the pH-telemetric methodology would be a useful noninvasive measure of gastrointestinal transit time for future ground-based and in-flight drug evaluation studies. The Heidelberg pH metering system is a noninvasive, nonradioactive telemetric system that, following oral ingestion, continuously measures intraluminal pH of the stomach, duodenum, small bowel, ileocecal junction, and large bowel. Gastrointestinal motility profiles were obtained in normal volunteers using the lactulose breath-hydrogen and Heidelberg pH metering techniques. All profiles were obtained in the morning after an overnight fast. Heidelberg pH profiles were obtained in the fasting and fed states; lactulose breath-hydrogen profiles were obtained after a standard breakfast. Mouth-to-cecum transit time was measured as the interval from administration of lactulose (30 ml; 20 g) to a sustained increase in breath-hydrogen of 10 ppm or more. Gastric emptying time was measured as the interval from the administration of the Heidelberg capsule to a sustained increase in pH of three units or more. Author

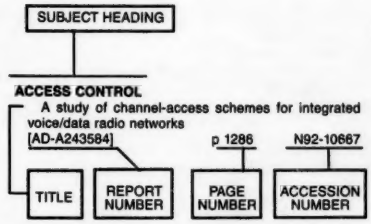
N92-21313*# Houston Univ., TX. Dept. of Curriculum and Instruction.

AN INTELLIGENT COMPUTER-AIDED TRAINING SYSTEM (CAT) FOR DIAGNOSING ADULT ILLITERATES: INTEGRATING NASA TECHNOLOGY INTO WORKPLACE LITERACY Final Report **c61**

David B. Yaden, Jr. *In* Texas A and M Univ., NASA/ASEE Summer Faculty Fellowship Program, 1991, Volume 2 Dec. 1991 12 p (For primary document see N92-21300 12-99)
Avail: NTIS HC/MF A09 CSCL 09B

An important part of NASA's mission involves the secondary application of its technologies in the public and private sectors. One current application being developed is The Adult Literacy Evaluator, a simulation-based diagnostic tool designed to assess the operant literacy abilities of adults having difficulties in learning to read and write. Using Intelligent Computer-Aided Training (ICAT) system technology in addition to speech recognition, closed-captioned television (CCTV), live video and other state-of-the-art graphics and storage capabilities, this project attempts to overcome the negative effects of adult literacy assessment by allowing the client to interact with an intelligent computer system which simulates real-life literacy activities and materials and which measures literacy performance in the actual context of its use. The specific objectives of the project are as follows: (1) to develop a simulation-based diagnostic tool to assess adults' prior knowledge about reading and writing processes in actual contexts of application; (2) to provide a profile of readers' strengths and weaknesses; and (3) to suggest instructional strategies and materials which can be used as a beginning point for remediation. In the first and development phase of the project, descriptions of literacy events and environments are being written and functional literacy documents analyzed for their components. From these descriptions, scripts are being generated which define the interaction between the student, an on-screen guide and the simulated literacy environment. Author

Typical Subject Index Listing



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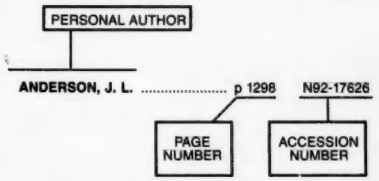

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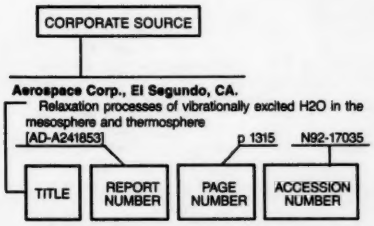

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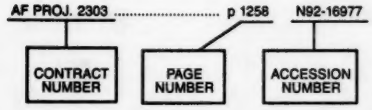

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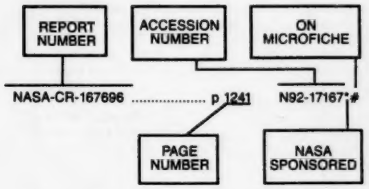

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AD-E200826 ..... p 2016 N92-21731 #

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AFIT/EN-TR-91-7 ..... p 2032 N92-21352 #

AFOSR-91-1007TR ..... p 2022 N92-21384 #
AFOSR-91-1010TR ..... p 2065 N92-21294 #
AFOSR-91-1026TR ..... p 2053 N92-21295 #

AGARD-CP-496 ..... p 1922 N92-21679 #
AGARD-CP-509 ..... p 1930 N92-21951 #

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ANL-91/34 ..... p 2030 N92-21135 #
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ANL/CP-75256 ..... p 1974 N92-21183 #
ANL/CP-75370 ..... p 1947 N92-21187 * #

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ARO-26072.17-CH-A ..... p 1973 N92-21815 #
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BBN-7628-VOL-2 ..... p 2032 N92-21391 #
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BBN-9108-VOL-4-APP ..... p 2033 N92-21861 #
BBN-9109-VOL-1 ..... p 2033 N92-21862 #
BBN-9109-VOL-2-APP ..... p 2033 N92-21863 #
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BBN-9112 ..... p 2034 N92-21867 #
BBN-9117-VOL-1 ..... p 2034 N92-21868 #
BBN-9117-VOL-2-APP ..... p 2034 N92-21869 #

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BNL-47033 ..... p 2064 N92-21198 #
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CONF-9105281 ..... p 2075 N92-21109 #
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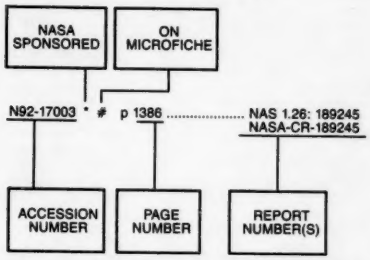

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Phoenix, AZ 85007
(602) 542-4121 FAX: (602) 542-4400; 542-4500

ARKANSAS

ARKANSAS STATE LIBRARY
State Library Services
One Capitol Mall
Little Rock, AR 72201
(501) 682-2869

CALIFORNIA

CALIFORNIA STATE LIBRARY
Govt. Publications Section
914 Capitol Mall - P.O. Box 942837
Sacramento, CA 94237-0001
(916) 322-4572 FAX: (916) 324-8120

COLORADO

UNIV. OF COLORADO - BOULDER
Norlin Library
Govt. Publications
Campus Box 184
Boulder, CO 80309-0184
(303) 492-8834 FAX: (303) 492-2185

DENVER PUBLIC LIBRARY
Govt. Publications Dept. BS/GPD
1357 Broadway
Denver, CO 80203
(303) 571-2135

CONNECTICUT

CONNECTICUT STATE LIBRARY
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971 FAX: (203) 566-3322

FLORIDA

UNIV. OF FLORIDA LIBRARIES
Documents Dept.
Library West
Gainesville, FL 32611-2048
(904) 392-0366 FAX: (904) 392-7251

GEORGIA

UNIV. OF GEORGIA LIBRARIES
Govt. Documents Dept.
Jackson Street
Athens, GA 30602
(404) 542-8949 FAX: (404) 542-6522

HAWAII

UNIV. OF HAWAII
Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230 FAX: (808) 956-5968

IDAHO

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344 FAX: (208) 885-6817

ILLINOIS

ILLINOIS STATE LIBRARY
Reference Dept.
300 South Second
Springfield, IL 62701-1796
(217) 782-7596 FAX: (217) 524-0041

INDIANA

INDIANA STATE LIBRARY
Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3678 FAX: (317) 232-3728

IOWA

UNIV. OF IOWA LIBRARIES
Govt. Publications Dept.
Washington & Madison Streets
Iowa City, IA 52242
(319) 335-5926 FAX: (319) 335-5830

KANSAS

UNIV. OF KANSAS
Govt. Documents & Map Library
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Lawrence, KS 66045-2800
(913) 864-4660 FAX: (913) 864-5380

KENTUCKY

UNIV. OF KENTUCKY LIBRARIES
Govt. Publications/Maps Dept.
Lexington, KY 40506-0039
(606) 257-3139 FAX: (606) 257-1563; 257-8379

LOUISIANA

LOUISIANA STATE UNIV.
Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803
(504) 388-2570 FAX: (504) 388-6992

LOUISIANA TECHNICAL UNIV.
Prescott Memorial Library
Govt. Documents Dept.
305 Wisteria Street
Ruston, LA 71270-9985
(318) 257-4962 FAX: (318) 257-2447

MAINE

TRI-STATE DOCUMENTS DEPOSITORY
Raymond H. Fogler Library
Govt. Documents & Microforms Dept.
Univ. of Maine
Orono, ME 04469
(207) 581-1680

MARYLAND

UNIV. OF MARYLAND
Hornbake Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 454-3034 FAX: (301) 454-4985

MASSACHUSETTS

BOSTON PUBLIC LIBRARY
Govt. Documents Dept.
666 Boylston Street
Boston, MA 02117
(617) 536-5400 ext. 226
FAX: (617) 267-8273; 267-8248

MICHIGAN

DETROIT PUBLIC LIBRARY
5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1440; 833-1409
FAX: (313) 833-5039

LIBRARY OF MICHIGAN
Govt. Documents Unit
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640 FAX: (517) 373-3381

MINNESOTA

UNIV. OF MINNESOTA
Wilson Library
Govt. Publications Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624-5073 FAX: (612) 626-9353

MISSISSIPPI

UNIV. OF MISSISSIPPI
J.D. Williams Library
Federal Documents Dept.
106 Old Gym Bldg.
University, MS 38677
(601) 232-5857 FAX: (601) 232-5453

MISSOURI

UNIV. OF MISSOURI - COLUMBIA
Ellis Library
Govt. Documents
Columbia, MO 65201
(314) 882-6733 FAX: (314) 882-8044

MONTANA

UNIV. OF MONTANA
Maureen & Mike Mansfield Library
Documents Div.
Missoula, MT 59812-1195
(406) 243-6700 FAX: (406) 243-2060

NEBRASKA

UNIV. OF NEBRASKA - LINCOLN
D.L. Love Memorial Library
Documents Dept.
Lincoln, NE 68588
(402) 472-2562

NEVADA

UNIV. OF NEVADA
Reno Library
Govt. Publications Dept.
Reno, NV 89557
(702) 784-6579 FAX: (702) 784-1751

NEW JERSEY

NEWARK PUBLIC LIBRARY
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Newark, NJ 07101-0630
(201) 733-7812 FAX: (201) 733-5648

NEW MEXICO

UNIV. OF NEW MEXICO
General Library
Govt. Publications Dept.
Albuquerque, NM 87131-1466
(505) 277-5441 FAX: (505) 277-6019

NEW MEXICO STATE LIBRARY
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826 FAX: (505) 827-3820

NEW YORK

NEW YORK STATE LIBRARY
Documents/Gift & Exchange Section
Federal Depository Program
Cultural Education Center
Albany, NY 12230
(518) 474-5563 FAX: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA - CHAPEL HILL
CB#3912, Davis Library
BA/SS Dept.—Documents
Chapel Hill, NC 27599
(919) 962-1151 FAX: (919) 962-0484

NORTH DAKOTA

NORTH DAKOTA STATE UNIV. LIBRARY
Documents Office
Fargo, ND 58105
(701) 237-8886 FAX: (701) 237-7138
In cooperation with Univ. of North Dakota, Chester Fritz Library
Grand Forks

OHIO

STATE LIBRARY OF OHIO
Documents Dept.
65 South Front Street
Columbus, OH 43266
(614) 644-7051 FAX: (614) 752-9178

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES
U.S. Govt. Information Div.
200 NE 18th Street
Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 252, 253
FAX: (405) 525-7804

OKLAHOMA STATE UNIV.
Edmon Low Library
Documents Dept.
Stillwater, OK 74078
(405) 744-6546 FAX: (405) 744-5183

OREGON

PORTLAND STATE UNIV.
Millar Library
934 SW Harrison - P.O. Box 1151
Portland, OR 97207
(503) 725-3673 FAX: (503) 725-4527

PENNSYLVANIA

STATE LIBRARY OF PENN.
Govt. Publications Section
Walnut St. & Commonwealth Ave. - P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

SOUTH CAROLINA

CLEMSON UNIV.
Cooper Library
Public Documents Unit
Clemson, SC 29634-3001
(803) 656-5174 FAX: (803) 656-3025
In cooperation with Univ. of South Carolina, Thomas Cooper Library, Columbia

TENNESSEE

MEMPHIS STATE UNIV. LIBRARIES
Govt. Documents
Memphis, TN 38152
(901) 678-2586 FAX: (901) 678-2511

TEXAS

TEXAS STATE LIBRARY
United States Documents
P.O. Box 12927 - 1201 Brazos
Austin, TX 78711
(512) 463-5455 FAX: (512) 463-5436

TEXAS TECH. UNIV. LIBRARY
Documents Dept.
Lubbock, TX 79409
(806) 742-2268 FAX: (806) 742-1920

UTAH

UTAH STATE UNIV.
Merrill Library & Learning Resources Center, UMC-3000
Documents Dept.
Logan, UT 84322-3000
(801) 750-2684 FAX: (801) 750-2677

VIRGINIA

UNIV. OF VIRGINIA
Alderman Library
Govt. Documents
Charlottesville, VA 22903-2498
(804) 924-3133 FAX: (804) 924-4337

WASHINGTON

WASHINGTON STATE LIBRARY
Document Section
MS AJ-11
Olympia, WA 98504-0111
(206) 753-4027 FAX: (206) 753-3546

WEST VIRGINIA

WEST VIRGINIA UNIV. LIBRARY
Govt. Documents Section
P.O. Box 6069
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

ST. HIST. SOC. OF WISCONSIN LIBRARY
Govt. Publications Section
816 State Street
Madison, WI 53706
(608) 262-2781 FAX: (608) 262-4711
In cooperation with Univ. of Wisconsin-Madison, Memorial Library

MILWAUKEE PUBLIC LIBRARY
Documents Div.
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-2167 FAX: (414) 278-2137

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